

LOWELL REGIONAL TRANSIT AUTHORITY

GALLAGHER TERMINAL

117 THORNDIKE STREET, LOWELL, MA 01852

&

MAGUIRE TRANSPORTATION CENTER

115 THORNDIKE STREET, LOWELL, MA 01852

STANDBY GENERATOR PROJECT

PROJECT MANUAL – BID & CONTRACT DOCUMENTS

AECOM

1 FEDERAL STREET, 8TH FLOOR
BOSTON, MASSACHUSETTS 02110

AUGUST 2026

CONSTRUCTION SPECIFICATIONS

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INVITATION FOR BIDS for STANDBY GENERATOR

The Lowell Regional Transit Authority (LRTA) invites qualified firms to submit Bids to provide and install a new 250KW standby generator to serve the Gallagher Intermodal Transportation Center and the Maguire Center. The Bids must be developed and submitted in accordance with the specifications, requirements, and criteria contained within the Invitation for Bids (IFB) Document and Project Drawings.

The LRTA will accept sealed Bids for the new Standby Generator at the Administrative Offices in the Gallagher Intermodal Transportation Center (GITC), located at 115 Thorndike Street, Floor 3B, Lowell, MA 01852. Bids will be accepted until September 29, 2026, at 10:00AM. Any Bids received after this time will be considered to be late and non-responsive and will not be considered.

The performance of any Contract which may arise from this Bid is subject to the requirements of Title VI of the Civil Rights Act of 1964 and all applicable Equal Employment Opportunity requirements as may be generally applicable to this type of solicitation.

This Project solicitation and any Contract arising from this IFB will be subject to the availability of financial assistance from the Federal Transit Administration (FTA). Bidders are advised that the LRTA requires the included **Statement of Bidder's Qualifications** to be filed with the Bid. All Bids shall be accompanied by a bid deposit in the form of a bank or certified check or a Bid Bond in the amount of five percent (5%) of the Bid Price.

The Project wages are subject to the Federal Department of Labor's schedule of wage rates, which are included in the Bid Documents. All Bidders will be required to certify that they are not on the United States Comptroller General's list of ineligible contractors.

A Pre-Bid site review meeting will be held at 10:00AM on Tuesday September 15, 2026 at the LRTA Administrative Offices in the GITC, 115 Thorndike Street, Floor 3B, Lowell, MA for the purpose of inquiries concerning the Project and the Bid Documents.

The IFB documents can be obtained online at: <https://lrta.com/procurement/standby-generator-project/>, which will have all IFB documentation uploaded directly. To be notified when new documentation is posted to the LRTA website via email, inform the LRTA Procurement Director of your interest to be listed on the "Standby Generator Email List" by emailing m.obrien@lrta.com or by calling (978) 459-0164 ext. 110 and providing your email to be contacted.

The LRTA reserves the right to waive any formalities, to reject any and all Bids, and to award the Contract to any Proposer whose Bid is deemed to be the most advantageous to the interest of the public and the LRTA. The LRTA, when appropriate, reserves the right to conduct a cost and price analysis.

Questions with regard to the Bid Procedure may be directed to Ms. Meaghan O'Brien, LRTA Procurement Director, at the LRTA's Administrative Office. Email: m.obrien@lrta.com or Tel. (978) 459-0164 ext. 110.

David Bradley
LRTA ADMINISTRATOR

September 8, 2026



Introduction & Background

The Lowell Regional Transit Authority (LRTA) is inviting sealed Bids from qualified firms to provide and INSTALL A NEW STANDBY GENERATOR to serve the Gallagher Intermodal Transportation Center (GITC) and the Maguire Transportation Center. These facilities are part of the overall LRTA property which also includes the Raymond Rourke Parking Garage.

Sealed Bids will be accepted until 10 AM on Tuesday, October 6, 2026 at the LRTA Administrative Office, Floor 3B, 115 Thorndike Street, Lowell, MA, 01852. Bids received at the LRTA by that time and date shall then be opened and recorded as received for further evaluation and compliance with the IFB requirements. Award of a contract will be made to the lowest, responsive and responsible bidder. Bids received after that date and time will not be accepted and shall be returned to the sender.

The Lowell Regional Transit Authority (LRTA) is a body politic and corporate political subdivision of the Commonwealth of Massachusetts, established under Chapter 161B of the Massachusetts general Laws on 1973. The LRTA member communities are Lowell, Acton, Billerica, Carlisle, Chelmsford, Dracut, Dunstable, Groton, Maynard, Pepperell, Tewksbury, Townsend, Tyngsborough, Westford, and Wilmington.

The LRTA maintains its Administrative Offices within the Charles A. Gallagher Intermodal Transportation Center (GITC) in Lowell, Mass. The LRTA opened its Robert C. Maguire Transportation Center in 2001. The Kennedy Bus Transfer Center is located outside and in front of the main lobby entrance of the GITC and serves as the operating hub for all of the LRTA's fixed route bus services.

Fixed route bus services are directly operated under contract by First Transit Management of Lowell (Transdev). Service is provided f=over the LRTA's 21 bus routes, utilizing a modern transit fleet o fifty-four (54) buses operating from the Fixed Route Bus Garage, 100 Hale Street, Lowell, MA. Fixed route ridership for fiscal year 2026 equals approximately 1,300,000 trips.

Elderly and disabled paratransit services are dispatched and operated by Transdev Paratransit Management of Lowell, Inc. from the Maguire Transportation Center. Current ridership is over 30,000 trips per fiscal year.

Within the GITC, the MBTA operates the Lowell Line commuter rail route to North Station in Boston via Twenty-Three weekday round trips. Parking is available at the GITC for over 1,000 cars.



Selection Process

The LRTA will advertise and distribute the IFB solicitation documents in a manner that is intended to maximize competition for the STANDBY GENERATOR project as specified.

A Pre-Bid site review meeting will be held at the LRTA Administrative Office, GITC, 115 Thorndike Street, Floor 3B, Lowell, Massachusetts **10 A.M. on Monday, September 21, 2026.** All interested firms are welcome and urged to attend, as a visit to the proposed site of the new generator will be offered to all attendees.

The LRTA shall award the Standby Generator Project contract to the firm which submits to the lowest, responsive and responsible Bid.

All Bidders shall be bound to their Bids for sixty (60) days. The LRTA Administrator reserves the right to rule on any inconsistencies or errors in the Bid Documents and Bid Solicitation procedures and such ruling(s) shall be deemed binding to all Bidders. The LRTA shall award the Project contract to the firm which submits the lowest, responsive and responsible Bid.

Any Contract which may arise from this Invitation for Bids is subject to available financial assistance from the Federal Transit Administration (FTA). The LRTA is a tax-exempt Authority. Bidders should not include taxes in the prices proposed. The LRTA's tax exemption number will be provided to the winning Bidder. The LRTA reserves the right to negotiate any term of the Bid submitted. The LRTA reserves the right to waive any formalities, to reject any and all Bids and to award the Contract to the Bidder whose Bid is deemed the most advantageous to the best interests of the public and the LRTA.



Instruction to Bidders

LOWELL REGIONAL TRANSIT AUTHORITY

Gallagher Intermodal Transportation Center 115 Thorndike Street
Lowell, Massachusetts 01852

Architect/Engineer: AECOM USA of Massachusetts Inc.
1 Federal Street, 8th Floor
Boston, MA 02210

For:

STANDBY GENERATOR

1. SECURING DOCUMENTS: Copies of the proposed Contract Documents may be obtained for bidding purposes upon the conditions set forth in these Instructions for Bidders.

2. BIDDER'S QUALIFICATION: Qualification of contractors is a requirement of the Contract Documents. General Bidders shall submit with their bid, among other documents required by the Bid Documents, a Statement of Bidder's Qualifications and a Certification of Similar Projects. This shall be used for the purpose of aiding the Authority in determining the lowest responsible and eligible bidder. Failure of bidders to fill out and submit the Statements with their may be grounds for rejection of the bid or sub-bid.

3. EXAMINATION OF CONTRACT DOCUMENTS AND SITE OF WORK: The Bidder is required to examine carefully in detail the Technical Specifications and Drawings as defined in the IFB Documents, and all other matters pertinent to the proposed work. It will be assumed that he/she has satisfied himself/herself as to the conditions to be encountered overhead, on the surface and underground; the character, quality and quantities of work to be done and material to be furnished; and the requirements of the Contract and Specifications. No allowance or concession will be made for the lack of such information on the part of the Contractor.

Bidders shall ascertain and obtain all governmental and other permits, approvals, consents and requirements with respect to wage scales, trench & structural excavations, equipment, materials, labor, safety and sanitation, and shall base their Bid price on full compliance therewith.

3.1 Subsurface Investigations: Bidders are hereby advised that before drilling, if necessary, any holes or excavating any test pits for the purpose of satisfying themselves as to underground conditions, they must secure permission in writing to do such drilling or test pit excavation from authorized officials of the Authority and any governmental bodies and agencies having jurisdiction. It is a requirement of this Contract that DIG SAFE be notified by the bidder at 1 (888) 344-7233 before any excavation is performed.



4. ADDENDA AND INTERPRETATIONS: All questions by prospective Bidders as to the interpretation of the Instruction to Bidders, form of contract, plans, specifications, drawings, or any other matter pertaining to this solicitation must be submitted in writing to the Authority (referred to herein as LRTA, Owner, or Authority) and shall be in its possession not later than 5:00 p.m. on SEPTEMBER 25, 2026. Any interpretation of the Contract Documents will be made only by an Addendum issued by the Authority. All Addenda will be posted on the LRTA Website or emailed by the Authority to all bidders who have requested to be placed on the mailing list through contacting Procurement Director, Meaghan O'Brien at m.obrien@lrta.com before the date set for the opening of bids. Oral interpretations given to prospective bidders are not binding, all formal requests and responses must be done in writing.

4.1 Addenda Acknowledgement: Each bidder is required to acknowledge receipt of all Addenda in the spaces provided in the Bid form. It shall be the sole responsibility of Bidders to ascertain the existence of any and all Addenda issued by the LRTA whether or not the Addenda are presented or mailed to or received by the bidders. Failure to acknowledge receipt of all Addenda may cause the Bid to be rejected.

5. SURETY: Should the Surety of any Bond furnished in connection with the Contract Documents become unacceptable or be deemed unsatisfactory to the Authority at any time, the Contractor shall, upon written notice from the Authority, promptly furnish acceptable or substitute Surety as may be required to protect the interests of the Authority or of persons supplying services (including rental of equipment), labor, or materials in the prosecution of the work under the Contract Documents. No further payment shall be deemed due or shall be made under the Contract Documents until the new Surety or Sureties shall qualify and be accepted by the Authority.

5.1 Bid Deposit: Each Bid shall be accompanied by a Bid deposit in the form of a bank treasury check, certified check, or bid bond, payable to the Lowell Regional Transit Authority, in the amount of 5 percent (5%) of the total Bid price (based Bid plus any and all alternates). Such bid deposit of the successful Bidder shall be used for the payment of liquidated damages to the Authority in the manner described in the form of the "Bid Bond" (as bound herein and part of these Contract Documents) should the successful bidder fail to furnish a signed contract in the form provided in the Bid Documents, the Performance Bond, the Payment Bond, and the insurance certificates and copies of policies as specified in the Contract Documents, within five (5) days (Saturdays, Sundays and legal holidays excluded) after notification by the Authority to furnish such contract, bonds, etc.

Within ten (10) days after the formal opening of bids (Saturdays, Sundays, and legal holidays excluded), the bid deposits of the Bidders will be returned excepting those Bid deposits of the three (3) lowest responsible and eligible Bidders. Upon the execution of a Contract and furnishing of bonds and insurance certificates by the lowest responsible and eligible Bidder, all remaining bid deposits will be returned. The security of the successful Bidder will be returned to him/her



when the Contract is executed by both parties hereto and the Contractor has furnished the bonds and insurance certificates as required by the Contract Documents.

5.2 Surety Bonds: Prior to award of Contract, the apparent successful Bidder will be required to furnish within the time specified under these Instructions a "PERFORMANCE Bond" covering faithful and satisfactory performance of the work contracted, in an amount no less than one hundred (100) percent of the Contract amount; and a PAYMENT Bond at an amount not less than one hundred (100) percent of the Contract amount, covering payment in full for all services (including reasonable rentals of equipment for certain periods) rendered, materials furnished, and labor supplied or performed. The same Surety must execute both Bonds.

6. PREPARATION OF BID: The Contractor shall prepare their Bid by completely filling in the forms contained in the Bid Form packets provided by the Authority. The various forms contained in the Bid Form packets must be properly executed in ink without alterations.

Using the prescribed forms, all Bid prices shall be written in ink in the blank spaces provided for each item, and all amounts totaled. For unit price items, the "unit price" shall govern in the event of occurrence of a multiplication error in arriving at a total price for the item bid.

The Bidder shall sign their name and give their business address in the space provided therefor. If the Bid is made by a partnership, it shall be signed by a general partner; if made by a corporation, it shall be signed in the name of the corporation by the President or Vice President, or by a duly authorized agent due proof of whose authority shall be attached, and shall have affixed the seal of the corporation attested by the Secretary or Assistant Secretary.

6.1 IF APPLICABLE: Approximate Estimate of Quantities if any Unit Prices Are Contained on Bid Form: The Bidder's attention is directed to the fact that in Contracts based on unit price, the estimated of quantities of work to be done and materials to be furnished under these Specifications, as indicated in the Bid form, are approximate and given only for the benefit of the Authority to be used as a basis for comparison of Bids. Neither the Authority nor the Engineer warrants or guarantees that the estimated quantities are accurate or will be encountered during the work, nor shall the Contractor make claim or plead misunderstanding or deception because of such estimated quantities, or the character of the work or location, or other conditions pertaining thereto. The Authority reserves the right to increase or diminish any or all of the estimated quantities of work or to omit any of them as it may deem necessary; and any such increase or decrease of the quantities given for any of the items shall not be considered as sufficient ground for granting an increase in the unit price bid.

6.2 Submitting Bid: Bids, accompanied by the Bid deposit, Statement of Bidder Qualifications, and such other documents as may be required by the Bid Documents, shall be submitted in an envelope, which shall be SEALED and addressed to the Authority. The Bidder's name shall appear



in the upper left-hand corner of the envelope. Each envelope must contain a USB drive containing an electronic version of the Bid being submitted.

7. RECEIPT OF BIDS: The place at which Bids must be delivered, the amount of the Bid deposit required, and the date, time, and place of opening of Bids are stated in these Instructions and/or the Invitation to Bid.

8. WITHDRAWAL OF BIDS: All Bidders specifically waive any right to withdraw a Bid after it has been submitted to the Authority, except as provided in the following:

8.1 Prior to Date and Time of Opening Bids: A Bidder may withdraw a Bid, prior to the date and time for the opening of Bids, if a written request to withdraw the Bid is delivered to the Authority by an accredited representative of the Bidder or by U.S. mail, and actually received by the Authority prior to the time set for the opening of Bids.

8.2 On and After Date and Time for Opening Bids: Except as otherwise expressly provided in Chapter 149 of the General Laws, no Bids may be withdrawn at the date and time for the opening of Bids or for a period of thirty (30) calendar days thereafter.

9. BID REJECTION: The unqualified right is reserved by the Authority, at its sole option, to waive any informalities, irregularities, defects, errors or omissions in any or all Bids and to reject any or all Bids as may be deemed to be in the best interest of the Authority to the fullest extent allowed by law. Bids which contain omissions, erasures, alterations, additions not called for, conditional bids, or irregularities of any kind, or Bids otherwise regular which are not accompanied by Bid deposit, may be rejected as informal (or shall be rejected if rejection is mandated by law). Bids which fail to comply with any instructions to Bidders or which are unbalanced may also be rejected.

10. FILING PROCEDURES

10.1 Bid documents submitted by all Bidders to the Authority shall each be submitted as single originals and enclosed in a single envelope and delivered to the address given in the Invitation to Bid by the time established for the opening of such bids. The envelope containing bid documents shall be sealed and clearly labeled with the words "Bid Documents" for the project name, the title, bidder's name, and bidder's business address. Each envelope must also contain a USB drive with an electronic copy of the Bid being submitted.



10.2 If forwarded by mail, the sealed envelope containing the Bid and other required documents and marked as directed above must be enclosed in another envelope addressed in the same manner. The Authority hereby disclaims any responsibility for receipt of mailed Bids in time for Bid opening. Bidders shall be solely responsible for ensuring that their bid is properly sealed, marked, enclosed, and delivered. The LRTA mailing address is:

LOWELL REGIONAL TRANSIT AUTHORITY (LRTA)
Attn.: MS. MEAGHAN O'BRIEN, PROCUREMENT DIR.
GALLAGHER INTERMODAL TRANSPORTATION CENTER
115 THORNDIKE STREET-LEVEL 3B LOWELL, MA 01852

10.3 Bids received prior to the time established herein for the opening of Bids will be securely kept, unopened. The officer whose duty it is to receive and to open all bids will, when the specified time has arrived for the opening of Bids, publicly open and read them. No responsibility will be attached to an officer for premature opening of a Bid not properly addressed or identified.

11. FOREIGN CORPORATIONS: The Authority shall not enter into a contract with a Bidder which is a foreign corporation until such foreign corporation has filed with the Authority a certificate of the State Secretary for the Commonwealth, stating that such corporation has complied with G.L. c. 156D, s. 15.03 and s.5 and the date of such compliance, and has not filed all annual reports required by G.L. c. 156D, s. 16.22. See also G.L. c. 30, s. 39L.

14. POWER OF ATTORNEY: Attorneys-in-fact who sign contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

15. AWARD OF CONTRACT:

15.1 The award of a Contract, if any, shall be made to the responsible and responsive eligible bidder submitting the lowest Bid price for the project work as specified. Said Bidder shall certify that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed in the work, which certification is contained on the Bid form, and meets all other qualification of the Contract Documents.

Essential information for the determination of such responsibility and eligibility shall be submitted in such form as the Authority may require, and shall include as a minimum those documents required by the Instruction to Bidders.

15.2 The LRTA shall have the right to determine the low bidder on the basis of the sum of the base bid accepted by the LRTA.

16. EXECUTION OF CONTRACT: The Bidder to whom an award, if any, is made shall execute the Contract Agreement and furnish the required performance and payment bonds within ten (10)



business days after being given notice of the award (Saturdays, Sundays and legal holidays excluded). The Authority may require appropriate evidence that the persons executing the Contract Agreement and the bonds for both the Bidder and his surety or sureties are duly empowered to do so. Separate performance and payment bonds are required, each in an amount at least equal to the Total Bid Price. The surety or sureties shall be a corporation or corporations acceptable to the Authority. Alterations, extensions of time for performance, extra and additional work and other changes authorized under the Contract Documents may be made without notice or consent of the surety and sureties.

17. PREVAILING WAGES/DAVIS-BACON/MASSACHUSETTS PREVAILING WAGE LAW:

All bids shall be based on payment of the minimum wages required by the Davis-Bacon Act (40 USC§276a -276a-5 (1995) 29 CFR§ 5 (1995)), as amended. Wage-rate schedules are included in these Bid Documents.



FORM FOR BIDS

Price Proposal & Installation Schedule Assurance Form:

A. New STANDBY GENERATOR & INSTALLATION per IFB Specifications

(Price includes all GENERATOR system equipment, installed, fully operational as described within the IFB Specifications, delivery, testing, training, warranty, bonds, insurances).

Total Price Proposed = \$ _____

Note: Attach full description of the GENERATOR to be provided.

B. Schedule Assurance:

State the number of weeks which you will require to deliver, install, and place in acceptable working condition the NEW STANDBY GENERATOR once the LRTA has issued an official NOTICE to PROCEED.

FROM NOTICE TO PROCEED, WE WOULD REQUIRE _____ WEEKS TO COMPLETE THE INSTALLATION & TRAINING AND HAVE THE SYSTEM WORKING IN FULL COMPLIANCE WITH THE RFP SPECIFICATIONS.

Signature of Authorized Representative of Bidder

Name and Address of Proposer

Email

Date

Phone & Fax Numbers

Email Address



Proposed Bid Schedule

- | | |
|-----------------------|---|
| A. SEPTEMBER 8, 2026 | Advertise Bid Request |
| B. SEPTEMBER 10, 2026 | Bid Documents Available Electronically or for Review at the LRTA Administrative Office Upon Request |
| C. SEPTEMBER 21, 2026 | Pre-Bid Site Review Meeting @ 10:00 AM @ LRTA Administrative Offices – 115 Thorndike Street, Floor 3B, Lowell, MA 01852 |
| D. SEPTEMBER 25, 2026 | Deadline for Bid Clarifications & Written Change Requests to be Submitted no later than 5:00 PM |
| E. OCTOBER 6, 2026 | Bids due by 10:00 AM @ LRTA Administrative Offices – 115 Thorndike Street, Floor 3B, Lowell, MA 01852 |
| F. OCTOBER 13, 2026 | Release Notice of Intent to Award |
| G. OCTOBER 20, 2026 | Award of Contract & Notice to Proceed Project Activities |
| H. OCTOBER 22, 2026 | Generator Project Begins |



Addendum Acknowledgement

The undersigned acknowledges receipt of the following addenda to the Bid documents
(give number and date of each):

Addendum No. _____ Dated _____ Addendum No. _____ Dated _____

Addendum No. _____ Dated _____ Addendum No. _____ Dated _____

Addendum No. _____ Dated _____ Addendum No. _____ Dated _____

Addendum No. _____ Dated _____ Addendum No. _____ Dated _____

Addendum No. _____ Dated _____ Addendum No. _____ Dated _____

Signature

Title

Date



Presentation of References

I herein certify that the information following showing Authority / Company / Municipality name, address, telephone number, and contact person is a representative list of Authorities / Companies / Municipalities which have contracted with this firm. This list is presented in compliance with the RFP/IFB instructions and requirements

References (attach list if needed):

 Name Address Phone Contact Person	 Name Address Phone Contact Person
 Name Address Phone Contact Person	 Name Address Phone Contact Person

Certified to by: _____
(Signature and Title)



Completeness of Bid

I herein certify that I have read and understand all Bidding documents and any amendments, changes and Addenda submitted by the Lowell Regional Transit Authority and that I have fully complied with all provisions of same.

I further certify and represent that any omission or deviation from these documents may or will, at the sole discretion of the LRTA, render this bid unresponsive and ineligible for further consideration in this bidding process.

Firm

Date

Name

Signature

Title

Email

Telephone No.

FAX No.



Statement of Bidder's Qualifications

1. Name of Bidder / Proposer: _____
2. Business Address: _____

3. When Organized: _____
4. Where Incorporated: _____
5. How many years has your firm been engaged in this business under its present name?:

6. Have you ever refused to sign a contract at your original bid or proposed price?:

7. Have you ever defaulted on a contract?: _____
8. Will you, upon request furnish any other information (appropriate to this solicitation) that the Authority may require?: _____
9. The undersigned hereby authorizes requests of any appropriate person to furnish any information requested by the LRTA in verification of the recitals comprising this Statement of the Proposer's Qualifications.

Firm/Proposer Name:

Signed by: Name & Title

Date:



Certification of Corporate Authority

At a duly authorized meeting of the Board of Directors of

(Name of Corporation)

held on _____ it was VOTED that: _____
(Date) (Name)

_____ of this corporation, be and he/she hereby is
(Officer)

authorized to execute contracts, deeds and bonds in the name and on behalf of said corporation, and affix its corporate seal hereto; and such execution of any contract, deed or obligation in this corporation's name on its behalf by such _____ under
(Officer)

seal of the company, shall be valid and binding upon this corporation.

A True Copy,

ATTEST: _____

TITLE: _____

PLACE OF BUSINESS: _____

DATE OF THIS CERTIFICATE: _____

I hereby certify that I am the clerk of the _____ that
_____ is duly elected _____ of
said corporation, and that the above vote has not been amended or rescinded and
remains in full force and effect as of the date of this contract.

(Clerk)

CORPORATE SEAL:



Certification of Primary Participant

The primary participant, _____, certifies to the best of its knowledge and belief, that it and its principals:

1.Are not presently debarred, suspended, purposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal Department or Agency;

2.Have not within a three-year period preceding this Bid been convicted of or had a civil judgement rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3.Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (2) of this certification; and

4.Have not within a three-year period preceding this application/Bid had one or more public transaction (Federal, State or Local) terminated for cause of default.

The primary participant, certifies or affirms the truthfulness and accuracy of the contents of the statements submitted on or with this certification on understands that the provisions of 31 U.S.C. sections 3801 ET SEO. Are applicable thereto.

Signature and Title of Authorized Official

Date



Certification Regarding Debarment, Suspension, and Other Responsibility Matters

Lower Tier Covered Transactions (Third Party Contracts over \$25,000)

Instructions for Certification.

1.By Signing and submitting this bid the prospective lower tier participant is providing the signed certification set out below.

2.The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, LRTA may pursue available remedies, including suspension and/or debarment.

3.The prospective lower tier participant shall provide immediate written notice to LRTA if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances,

4.The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "persons," "lower tier covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549 [49 CFR Part 29]. You may contact LRTA for assistance in obtaining a copy of those regulations.

5.The prospective lower tier participant agrees by submitting this bid that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized in writing by LRTA.

6.The prospective lower tier participant further agrees by submitting this bid that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.



7.A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the No Procurement List issued by U. S. General Service Administration.

8.Nothing contained in the foregoing shall be construed to require establishment of system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9.Except for transaction authorized under Paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to all remedies available to the Federal Government, LRTA may pursue available remedies including suspension and/or debarment.

“Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction”

(1) The prospective lower tier participant certifies, by submission of this bid or proposal, that neither it nor its “principals” [as defined at 49 C.F.R. section 29.105(p)] is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) When the prospective lower tier participant is unable to certify to the statements in this certification, such prospective participant shall attach an explanation to this bid or proposal.

Signature

Title

Date

Date

Organization/Company



Certificate of Eligibility

_____ Certifies that neither it, nor any of
(Name of Company)

its subcontractors used in performing this contract, are listed on the list of persons or firms currently debarred for violations of various public contracts incorporating labor standards provisions maintained by the Comptroller General of the United States.

DATE: _____

By: _____

TITLE: _____



Certification of Compliance RE: Executive Order 14173

A BIDDER / PROPOSER WILL NOT BE ELIGIBLE FOR THE AWARD OF ANY CONTRACT UNDER THIS INVITATION FOR BIDS / REQUESTS FOR PROPOSALS UNLESS SUCH BIDDER OR PROPOSER HAS SUBMITTED AS PART OF ITS BID / PROPOSAL THE FOLLOWING CERTIFICATION WHICH WILL BE DEEMED A PART OF THE RESULTING CONTRACT:

The Bidder / Proposer hereby certifies that it does not operate any programs promoting Diversity, Equity, and Inclusion ("DEI") that violate any applicable Federal anti-discrimination laws. The contractor is required to agree that its compliance in all respects with all applicable Federal anti-discrimination laws is material for purposes of the False Claims Act (FCA), subjecting federal contractors to treble damages and penalties under the FCA for violations of Federal anti-discrimination laws. Executive Order 14173 rescinds Executive Order 11246 and federal contractors are no longer required to create affirmative action plans for females and minorities.

Signature of Authorized Representative of Bidder / Proposer

Name of Authorized Bidder / Proposer

Address of Bidder / Proposer

Company

Title

Date



Buy America Certificate

This procurement is subject to the FEDERAL TRANSIT ADMINISTRATION'S Buy America Requirements in 49 CFR 661.13.

A Buy America Certificate, as per attached form, must be completed and submitted with the bid. A bid which does not include the certificate will be considered non-responsive.

A waiver from the Buy America Provision may be sought by (Recipient) if grounds for the waiver exist.

In order to qualify as a domestic end-product, the cost of components produced in the United States must exceed 70 percent (70%) to the cost of all components, and final assembly must take place in the United States. Additionally, any manufactured good must be 100 percent (100%) produced in the United States to qualify. This includes both components, and assembly.

BUY AMERICA CERTIFICATE

The proposer/bidder/contractor hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 CFR 661.

Date: _____ Company: _____

Signature: _____ Title: _____

CERTIFICATE OF NON-COMPLIANCE

The proposer/bidder/contractor hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323 (J)(1), but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(B) or (j)(2)(D) and the regulations in 49 CFR 661.7.

Date: _____ Company: _____

Signature: _____ Title: _____



State of (_____) County of (_____)

Date: _____

The undersigned being duly sworn, deposes and says that he/she is the sole owner; partner; president, treasurer, or other duly authorized official of corporation of

_____, for work in _____
(name of bidder as appearing in submitted bid) (City/Town/State)

on _____; and certifies under penalties of perjury that this bid is
(opening date of bid)

in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this paragraph the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

Signature & title of person making Affidavit

Sworn to before this (_____) day of _____ 2026.

Notary Public

My commission expires:



Non-Collusion Certification

By submission of this Bid, each Bidder and each person signing on behalf of any Bidder certifies under penalty of perjury, that to be the best of their knowledge and belief:

1. The prices in this Bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition as to any other matter relating to such prices with any other Bidder or with any other competitor.
2. Unless otherwise required by law, the prices which have been quoted in this Bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to opening, directly or indirectly, to any other Bidder or to any competitor; and,
3. No attempt has been made or will be made by the Bidder to induce any other person, partnership or corporation to submit or not to submit a Bid for the purpose of restricting competition.

Signature: _____ Title: _____

Organization/Company: _____ Date _____



Equal Employment Opportunity

The _____ certifies that it is in
(Company / Partnership / Individual)

conformance with all applicable federal and state equal employment opportunity laws and regulations and that it does not discriminate in any of its employment practices on the basis of race, color, religion, national origin, age, sex or marital status.

Date: _____ By _____

Title: _____



Access to Records

Access to Records. The following access to records requirements apply to this Contract:

1. Contractor agrees to provide the Authority, FTA Administrator, the Comptroller General of the United States or any of their duly authorized representatives with access to any books, documents, papers and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions.
2. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
3. The Contractor agrees to maintain all books, records, accounts and reports required under this contract for a period of not less than three years from the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until the LRTA, the FTA Administrator, the Comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18:39(I)(II).

Signature of Authorized Representative of Bidder

Date



Certification of Dumping Facilities

I, _____ certify that I have
adequate dumping facilities available at; _____
_____ and that
these facilities will be used in connection with work undertaken on this Contract and
that such use will be in a manner compliant with State and Local requirements.

Signature of Authorized Representative Bidder

Name and Address of Bidder:

Date

Certification Regarding Lobbying

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies to the best of his or her knowledge and belief. that:

1. No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement and the extension, renewal, continuation, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL. "DISCLOSURE FORM TO REPORT LOBBYING" in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/9/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1996 (P.L. 104-65, to be codified at 2 U.S.C. 1601, et seq.)].
3. The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants, and contracts under grants, loans, and cooperative agreements) and that all sub recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. section 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure. [Note: Pursuant to 31 U.S.C. section 1352 (c)(1) -(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure or failure.]



The Contractor certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.A. section 3801, et seq., apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Official:

Name and Title of Contractor's Authorized Official:

Date: _____



Implementation of the Clean Air Act

By signing this Bid/Proposal, the Bidder/Proposer will be deemed to have stipulated as follows:

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. sec 7401 et seq. The Contractor agrees to report each violation to the Authority and understands and agrees that the Authority will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The Contractor agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FTA.

Contractor:_____

Title:_____

Date:_____



Certification Requirement for Steel, Iron, or Manufactured Goods

Certificate of Compliance with 49 U.S.C. 5323(j)(1)

The bidder hereby certifies that it will meet the requirements of 49 U.S.C. 5323(j)(1) and the applicable regulations in 49 CFR Part 661.

Date_____

Signature_____

Company Name_____

Title_____

Certificate of Non-Compliance with 49 U.S.C. > 5323(j)(1)

The bidder hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j)(1), but it may qualify for an exception pursuant to 49 U.S.C. 5323(j)(2)(B) or (j)(2)(D) and the regulations in 49 CFR 661.7.

Date_____

Signature_____

Company Name_____

Title_____



Bonding Requirements

- (a) Bid security equivalent to five (5) percent of the bid price must accompany the Bid. The "bid security" shall consist of a firm commitment such as a bid bond, certified, treasurer's, or cashier's check, issued by a responsible bank or trust company, payable to the Lowell Regional Transit Authority, as assurance that the Proposer will, upon acceptance of his bid, execute such contractual documents as may be required within the time specified.
- (b) A performance bond on the part of the Contractor for one hundred (100) percent of the contract price. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under the contract.
- (c) A payment bond on the part of the Contractor for one hundred (100) percent of the contract price. A "payment bond" is one executed in connection with a contract to assure payment, as required by law, of all persons supplying labor and material in the execution of the work provided for in the contract.
- (d) A cash deposit, certified check or other negotiable instrument may be accepted by a grantee in lieu of performance and payment bonds, provided the grantee has established a procedure to assure that the interest of FTA is adequately protected. An irrevocable letter of credit would also satisfy the requirement for a bond.

Signature:

Date:



Protest Procedures

Protests will be accepted only from prospective proposers or bidders whose direct economic interest would be affected by the award of a contract or by failure to award a contract. Any protests shall be in writing, submitted to the Administrator of the Lowell Regional Transit Authority, 115 Thorndike St., Lowell MA 01852-3308 and shall be submitted within the time limits specified in these procedures. Any protest that is not submitted in conformance with these procedures is null and void and shall not be considered.

All Protests shall include:

1. The name and address of the protestor;
2. The solicitation or project number, or description;
3. A detailed statement as to the nature of the protest.

Protests Prior to Bid/Proposal Opening: A protest based on alleged unduly restrictive specifications, alleged improprieties or other similar situations before bid or proposal opening, will be submitted so that it is received by the LRTA Administrator no later than five (5) full working days before the specified opening of the bids or proposals. A decision in writing by the LRTA Administrator or his designee will be returned to the protesting party in a timely manner prior to the bid/proposal opening if possible.

In the event a timely decision cannot be made, the LRTA may postpone the bid/proposal opening. All bids/proposals will remain unopened until the protest has been resolved, but no additional bids/proposals shall be accepted or modified after the originally scheduled day and time of opening. An addendum changing the day and time of the opening will be sent to each person/company that has requested and received a copy of the specifications.

Protests After Bid/Proposal Opening: A protest arising after the opening of the bids based upon grounds that were known or should have been known, must be submitted so that it is received by the LRTA Administrator within five (5) working days after notification of the apparent low responsive and responsible bidder. Any such protest must contain a statement of the grounds for protest and all supporting documentation. A decision in writing by the LRTA Administrator or his designee will be returned to the protesting party in a timely fashion.



Upon receipt of such protest the LRTA will immediately determine if the execution of a contract should be postponed. If it is postponed, the LRTA will notify all bidders that a protest has been filed and that the execution of the bid contract is postponed until the LRTA has issued its decision. Any protest may be withdrawn at any time before the LRTA has issued its decision.

The decision of the LRTA Administrator is final. No further appeals will be considered by the LRTA.

The signature below confirms the Bidder has read and understands the terms listed above.

Signature

Date

Required Clauses & Contract Provisions

ACCESS TO RECORDS AND REPORTS

1. Record Retention. The Contractor will retain, and will require its subcontractors of all tiers to retain, complete and readily accessible records related in whole or in part to the contract, including, but not limited to, data, documents, reports, statistics, leases, subcontracts, arrangements, other third party Contracts of any type, and supporting materials related to those records.
2. Retention Period. The Contractor agrees to comply with the record retention requirements in accordance with 2 C.F.R. § 200.334. The Contractor shall maintain all books, records, accounts and reports required under this Contract for a period of at not less than three (3) years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case records shall be maintained until the disposition of all such litigation, appeals, claims or exceptions related thereto.
3. Access to Records. The Contractor agrees to provide sufficient access to FTA and its contractors to inspect and audit records and information, including such records and information the contractor or its subcontractors may regard as confidential or proprietary, related to performance of this contract in accordance with 2 CFR § 200.337.
4. Access to the Sites of Performance. The Contractor agrees to permit FTA and its contractors access to the sites of performance under this contract in accordance with 2 CFR § 200.337.

AMERICANS WITH DISABILITIES ACT(ADA)

The contractor agrees to comply with all applicable requirements of section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, which prohibits discrimination on the basis of handicaps, with the Americans with Disabilities Act of 1990 (ADA), as amended, 42 U.S.C. §§ 12101 et seq., which requires that accessible facilities and services be made available to persons with disabilities, including any subsequent amendments to that Act, and with the Architectural Barriers act of 1968, as amended, 42 U.S.C. §§ 4151 et seq., which requires that buildings and public accommodations be accessible to persons with disabilities, including any subsequent amendments to that Act. In addition, the contractor agrees to comply with any and all applicable requirements issued by the FTA, DOT, DOJ, U.S. GSA, U.S. EEOC, U.S. FCC, any subsequent amendments thereto and any other nondiscrimination statute(s) that may apply to the Project.

BOND REQUIREMENTS

The Federal agency or pass-through entity may accept the recipient's or subrecipient's bonding policy and requirements for construction or facility improvement contracts or subcontracts exceeding the simplified acquisition threshold. Before doing so, the agency or pass-through entity must determine that the Federal interest is adequately protected. If such a determination has not been made, the minimum requirements must be as follows:

- (a) A bid guarantee from each bidder equivalent to five percent of the bid price. The bid guarantee must consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of the bid, execute any required contractual documents within the specified timeframe.



- (b) A performance bond on the contractor's part for 100 percent of the contract price. A performance bond is a bond executed in connection with a contract to secure the fulfillment of all the contractor's requirements under a contract.
- (c) A payment bond on the contractor's part for 100 percent of the contract price. A payment bond is a bond executed in connection with a contract to assure payment as required by the law of all persons supplying labor and material in the execution of the work provided for under a contract.

It is also understood and agreed that if the bidder should withdraw any part or all of their bid within [90] days after the bid opening without the written consent of the Agency, or refuse or be unable to enter into this Contract as provided above, or refuse or be unable to furnish adequate and acceptable Performance and Payment Bonds, or refuse or be unable to furnish adequate and acceptable insurance, as provided above, it shall forfeit its bid guaranty to the extent Agency's damages occasioned by such withdrawal, or refusal, or inability to enter into a Contract, or provide adequate security thereof.

It is further understood and agreed that to the extent the defaulting bidder's bid guaranty shall prove inadequate to fully recompense Agency for the damages occasioned by default, then the bidder agrees to indemnify Agency and pay over to Agency the difference between the bid guarantee and Agency's total damages so as to make Agency whole.

The bidder understands that any material alteration of any of the above or any of the material contained herein, other than that requested will render the bid unresponsive.

Performance Guarantee. A Performance Guarantee in the amount of 100% of the Contract value is required by the Agency to ensure faithful performance of the Contract. Either a Performance Bond or an Irrevocable Stand-By Letter of Credit shall be provided by the Contractor and shall remain in full force for the term of the Contract. The successful Bidder shall certify that it will provide the requisite Performance Guarantee to the Agency within ten (10) business days from Contract execution. The Agency requires all Performance Bonds to be provided by a fully qualified surety company acceptable to the Agency and listed as a company currently authorized under 31 C.F.R. part 22 as possessing a Certificate of Authority as described hereunder. Agency may require additional performance bond protection when the contract price is increased. The increase in protection shall generally equal 100 percent of the increase in contract price. The Agency may secure additional protection by directing the Contractor to increase the amount of the existing bond or to obtain an additional bond.

If the Bidder chooses to provide a Letter of Credit as its Performance Guarantee, the Bidder shall furnish with its bid, certification that an Irrevocable Stand-By Letter of Credit will be furnished should the Bidder become the successful Contractor. The Bidder shall also provide a statement from the banking institution certifying that an Irrevocable Stand-By Letter of Credit for the action will be provided if the Contract is awarded to the Bidder. The Irrevocable Stand-By Letter of Credit will only be accepted by the Agency if:

1. A bank in good standing issues it. The Agency will not accept a Letter of Credit from an entity other than a bank.
2. It is in writing and signed by the issuing bank.
3. It conspicuously states that it is an irrevocable, non-transferable, "standby" Letter of Credit.
4. The Agency is identified as the Beneficiary.
5. It is in an amount equal to 100% of the Contract value. This amount must be in U.S. dollars.
6. The effective date of the Letter of Credit is the same as the effective date of the Contract
7. The expiration date of the Letter of Credit coincides with the term of the contract.



8. It indicates that it is being issued in order to support the obligation of the Contractor to perform under the Contract. It must specifically reference the Contract between the Agency and the Contractor the work stipulated herein.

The issuing bank's obligation to pay will arise upon the presentation of the original Letter of Credit and a certificate and draft to the issuing bank's representative at a location and time to be determined by the parties. This documentation will indicate that the Contractor is in default under the Contract.

Payment Bonds. A Labor and Materials Payment Bond equal to the full value of the contract must be furnished by the contractor to Agency as security for payment by the Contractor and subcontractors for labor, materials, and rental of equipment. The bond may be issued by a fully qualified surety company acceptable to (Agency) and listed as a company currently authorized under 31 C.F.R. part 223 as possessing a Certificate of Authority as described thereunder.

BUY AMERICA REQUIREMENTS

The contractor agrees to comply with 49 U.S.C. 5323(j) and 49 C.F.R. part 661 and 2 CFR § 200.322 Domestic preferences for procurements, which provide that Federal funds may not be obligated unless all steel, iron, and manufactured products used in FTA funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 C.F.R. § 661.7.

Build America, Buy America Act. Construction materials used in the Project are subject to the domestic preference requirement of the Build America, Buy America Act, Pub. L. 117-58, div. G, tit. IX, §§ 70911 – 70927 (2021), as implemented by the U.S. Office of Management and Budget's "Buy America Preferences for Infrastructure Projects," 2 CFR Part 184. The Recipient acknowledges that this agreement is neither a waiver of § 70914(a) nor a finding under § 70914(b). In accordance with 2 CFR § 184.2(a), the Recipient shall apply the standards of 49 CFR Part 661 to iron, steel, and manufactured products.

Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C), 49 U.S.C. § 5323(u) and 49 C.F.R. § 661.11. Domestic preferences for procurements

The bidder or offeror must submit to the Agency the appropriate Buy America certification. Bids or offers that are not accompanied by a completed Buy America certification will be rejected as nonresponsive. For more information please see the FTA's Buy America webpage at: <https://www.transit.dot.gov/buyamerica>

CARGO PREFERENCE REQUIREMENTS

The contractor agrees:

- a. to use privately owned United States-Flag commercial vessels to ship at least 50 percent of any equipment, materials or commodities procured, contracted for or otherwise obtained with funds granted, guaranteed, loaned, or advanced by the U.S. Government under this agreement, and which may be transported by ocean vessel, shall be transported on privately owned United States-flag commercial vessels, if available. 46 U.S.C. § 55305, and U.S. Maritime Administration regulations, "Cargo Preference – U.S.-Flag Vessels," 46 CFR Part 381.
- b. to furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the



United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in 46 CFR § 381.7(a)(1) shall be furnished to both the recipient (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590; and

- c. to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.

CHANGES TO FEDERAL REQUIREMENTS

Federal requirements that apply to the Recipient or the Award, the accompanying Underlying Agreement, and any Amendments thereto may change due to changes in federal law, regulation, other requirements, or guidance, or changes in the Recipient's Underlying Agreement including any information incorporated by reference and made part of that Underlying Agreement; and

Applicable changes to those federal requirements will apply to each Third Party Agreement and parties thereto at any tier.

CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

The Contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. § 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. § 1251-1387). Violations must be reported to FTA and the Regional Office of the Environmental Protection Agency. The following applies for contracts of amounts in excess of \$150,000:

Clean Air Act

- (1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.
- (2) The contractor agrees to report each violation to the Agency and understands and agrees that the Agency will, in turn, report each violation as required to assure notification to the Agency, Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.
- (3) The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FTA.

Federal Water Pollution Control Act

- (1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
- (2) The contractor agrees to report each violation to the Agency and understands and agrees that the Agency will, in turn, report each violation as required to assure notification to the Agency, Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.
- (3) The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by FTA."

CIVIL RIGHTS LAWS AND REGULATIONS



The following Federal Civil Rights laws and regulations apply to all contracts.

The Contractor and any subcontractor agree to comply with all the requirements prohibiting discrimination on the basis of race, color, or national origin of the Title VI of the Civil Rights Act of 1964, as amended 42 U.S.C 2000d, and U.S. DOT regulation "Nondiscrimination in Federally-Assisted Programs of the Department of Transportation – Effectuation of the Title VI of the Civil rights Act," 49 C.F. R. Part 21 and any implementing requirement FTA may issue.

1.Federal Equal Employment Opportunity (EEO) Requirements. These include, but are not limited to:

- a) Nondiscrimination in Federal Public Transportation Programs. 49 U.S.C. § 5332, covering projects, programs, and activities financed under 49 U.S.C. Chapter 53, prohibits discrimination on the basis of race, color, religion, national origin, sex (including sexual orientation), disability, or age, and prohibits discrimination in employment or business opportunity.
- b) Prohibition against Employment Discrimination. Title VII of the Civil Rights Act of 1964, as amended, 42 U.S.C. § 2000e, Title VI of the Civil Rights Act of 1964," 49 CFR Part 21, and 49 U.S.C. § 5332, prohibits discrimination in employment on the basis of race, color, religion, sex, or national origin.

2.Nondiscrimination on the Basis of Sex. Title IX of the Education Amendments of 1972, as amended, 20 U.S.C. § 1681 et seq. and implementing Federal regulations, "Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance," 49 C.F.R. part 25 prohibit discrimination on the basis of sex.

3.Nondiscrimination on the Basis of Age. The "Age Discrimination Act of 1975," as amended, 42 U.S.C. § 6101 et seq., and Department of Health and Human Services implementing regulations, "Nondiscrimination on the Basis of Age in Programs or Activities Receiving Federal Financial Assistance," 45 C.F.R. part 90, prohibit discrimination by participants in federally assisted programs against individuals on the basis of age. The Age Discrimination in Employment Act (ADEA), 29 U.S.C. § 621 et seq., and Equal Employment Opportunity Commission (EEOC) implementing regulations, "Age Discrimination in Employment Act," 29 C.F.R. part 1625, also prohibit employment discrimination against individuals age 40 and over on the basis of age.

4.Federal Protections for Individuals with Disabilities. The Americans with Disabilities Act of 1990, as amended (ADA), 42 U.S.C. § 12101 et seq., prohibits discrimination against qualified individuals with disabilities in programs, activities, and services, and imposes specific requirements on public and private entities. Third party contractors must comply with their responsibilities under Titles I, II, III, IV, and V of the ADA in employment, public services, public accommodations, telecommunications, and other provisions, many of which are subject to regulations issued by other Federal agencies.

c) Civil Rights and Equal Opportunity

The Agency is an Equal Opportunity Employer. As such, the Agency agrees to comply with all applicable Federal civil rights laws and implementing regulations. Apart from inconsistent requirements imposed by Federal laws or regulations, the Agency agrees to comply with the requirements of 49 U.S.C. § 5323(h) (3) by not using any Federal assistance awarded by FTA to support procurements using exclusionary or discriminatory specifications. Under this Contract,



the Contractor shall at all times comply with the following requirements and shall include these requirements in each subcontract entered into as part thereof.

2 Nondiscrimination. In accordance with Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, sex, disability, or age. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

3 Equal Employment Opportunity. In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e et seq., Title I of the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. §§ 12101, et seq.; and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements, without regard to their race, color, religion, national origin, or sex (including sexual orientation). In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

4 Age. In accordance with the Age Discrimination in Employment Act, 29 U.S.C. §§ 621-634, U.S. Equal Employment Opportunity Commission (U.S. EEOC) regulations, "Age Discrimination in Employment Act," 29 C.F.R. part 1625, the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6101 et seq., U.S. Health and Human Services regulations, "Nondiscrimination on the Basis of Age in Programs or Activities Receiving Federal Financial Assistance," 45 C.F.R. part 90, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any Implementing requirements FTA may issue.

5 Disabilities. In accordance with section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. § 12101 et seq., the Architectural Barriers Act of 1968, as amended, 42 U.S.C. § 4151 et seq., and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against individuals on the basis of disability. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

6 Federal Law and Public Policy Requirements. The Contractor shall ensure that Federal funding is expended in full accordance with the U.S. Constitution, Federal Law, and statutory and public policy requirements: including, but not limited to, those protecting free speech, religious liberty, public welfare, the environment, and prohibiting discrimination.

CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

- a. Applicability: This requirement applies to all FTA grant and cooperative agreement programs.
- b. Where applicable (see 40 U.S.C. § 3701), all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704, as supplemented by Department of Labor regulations at 29 C.F.R. Part 5. See 2 C.F.R. Part 200, Appendix II.
- c. Under 40 U.S.C. § 3702, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week.

- d. The requirements of 40 U.S.C. § 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
- e. The regulation at 29 C.F.R. § 5.5(b) provides the required contract clause concerning compliance with the Contract Work Hours and Safety Standards Act:

Compliance with the Contract Work Hours and Safety Standards Act.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.
- (3) Withholding for unpaid wages and liquidated damages. The agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section."

DAVIS BACON ACT AND COPELAND ANTI-KICKBACK ACT

For all prime construction, alteration or repair contracts in excess of \$2,000 awarded by FTA, the Contractor shall comply with the Davis-Bacon Act and the Copeland "Anti-Kickback" Act. Under 49 U.S.C. § 5333(a), prevailing wage protections apply to laborers and mechanics employed on FTA assisted construction, alteration, or repair projects. The Contractor will comply with the Davis-Bacon

Act, 40 U.S.C. §§ 3141-3144, and 3146-3148 as supplemented by DOL regulations at 29 C.F.R. part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction." In accordance with the statute, the Contractor shall pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, the Contractor agrees to pay wages not less than once a week. The Contractor shall also comply with the Copeland "Anti-Kickback" Act (40 U.S.C. § 3145), as supplemented by DOL regulations at 29 C.F.R. part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in part by Loans or Grants from the United States." The Contractor is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled.

DOMESTIC PREFERENCES FOR PROCUREMENTS

- a. The recipient or subrecipient should, to the greatest extent practicable and consistent with law, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards, contracts, and purchase orders under Federal awards.
- b. For purposes of this section:
 - (1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
 - (2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.
- c. Federal agencies providing Federal financial assistance for infrastructure projects must implement the Buy America preferences set forth in 2 CFR 184.

DEBARMENT AND SUSPENSION

Debarment and Suspension (Executive Orders 12549 and 12689). A covered transaction (see 2 C.F.R. §§ 180.220 and 1200.220) must not be entered into with any party listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. 180 that implement Executive Orders 12549 (31 U.S.C. § 6101 note, 51 Fed. Reg. 6370,) and 12689 (31 U.S.C. § 6101 note, 54 Fed. Reg. 34131), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. The Recipient agrees to include, and require each Third Party Participant to include, a similar provision in each lower tier covered transaction, ensuring that each lower tier Third Party Participant:

- (1) Complies with federal debarment and suspension requirements; and
- (2) Reviews the SAM at <https://www.sam.gov>, if necessary to comply with U.S. DOT regulations, 2 CFR Part 1200.

ENERGY CONSERVATION

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency, which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201).

FLY AMERICA

a) Definitions. As used in this clause—

1) "International air transportation" means transportation by air between a place in the United States and a place outside the United States or between two places both of which are outside the United States. 2) "United States" means the 50 States, the District of Columbia, and outlying areas. 3) "U.S.-flag air carrier" means an air carrier holding a certificate under 49 U.S.C. Chapter 411.

b) When Federal funds are used to fund travel, Section 5 of the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) (Fly America Act) requires contractors, Agencies, and others use U.S.-flag air carriers for U.S. Government-financed international air transportation of personnel (and their personal effects) or property, to the extent that service by those carriers is available. It requires the Comptroller General of the United States, in the absence of satisfactory proof of the necessity for foreign-flag air transportation, to disallow expenditures from funds, appropriated or otherwise established for the account of the United States, for international air transportation secured aboard a foreign-flag air carrier if a U.S.-flag air carrier is available to provide such services.

c) If available, the Contractor, in performing work under this contract, shall use U.S.-flag carriers for international air transportation of personnel (and their personal effects) or property.

d) In the event that the Contractor selects a carrier other than a U.S.-flag air carrier for international air transportation, the Contractor shall include a statement on vouchers involving such transportation essentially as follows:

Statement of Unavailability of U.S.-Flag Air Carriers

International air transportation of persons (and their personal effects) or property by U.S.-flag air carrier was not available or it was necessary to use foreign-flag air carrier service for the following reasons. See FAR § 47.403. [State reasons]:

e) Contractor shall include the substance of this clause, including this paragraph (e), in each subcontract or purchase under this contract that may involve international air transportation.

INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION (FTA) TERMS

The provisions within include, in part, certain Standard Terms and Conditions required under the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards (2 CFR § 200), whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, detailed in 2 CFR § 200 or as amended by 2 CFR § 1201, or the most recent version of FTA Circular 4220.1 are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Contract. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any request which would cause a violation of the FTA terms and conditions.

NO GOVERNMENT OBLIGATION TO THIRD PARTIES

The Recipient and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying Contract, absent the

express written consent by the Federal Government, the Federal Government is not a party to this Contract and shall not be subject to any obligations or liabilities to the Recipient, Contractor or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying Contract. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by the FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

NOTICE TO FTA AND U.S. DOT INSPECTOR GENERAL OF INFORMATION RELATED TO FRAUD, WASTE, ABUSE, OR OTHER LEGAL MATTERS

If a current or prospective legal matter that may affect the Federal Government emerges, the Recipient must promptly notify the FTA Chief Counsel and FTA Regional Counsel for the Region in which the Recipient is located. The Recipient must include a similar notification requirement in its Third Party Agreements and must require each Third Party Participant to include an equivalent provision in its subagreements at every tier, for any agreement that is a "covered transaction" according to 2 C.F.R. §§ 180.220 and 1200.220.

(1) The types of legal matters that require notification include, but are not limited to, a major dispute, breach, default, litigation, or naming the Federal Government as a party to litigation or a legal disagreement in any forum for any reason.

(2) Matters that may affect the Federal Government include, but are not limited to, the Federal Government's interests in the Award, the accompanying Underlying Agreement, and any Amendments thereto, or the Federal Government's administration or enforcement of federal laws, regulations, and requirements.

(3) The Recipient must promptly notify the U.S. DOT Inspector General in addition to the FTA Chief Counsel or Regional Counsel for the Region in which the Recipient is located, if the Recipient has knowledge of potential fraud, waste, or abuse occurring on a Project receiving assistance from FTA. The notification provision applies if a person has or may have submitted a false claim under the False Claims Act, 31 U.S.C. § 3729 et seq., or has or may have committed a criminal or civil violation of law pertaining to such matters as fraud, conflict of interest, bribery, gratuity, or similar misconduct. This responsibility occurs whether the Project is subject to this Agreement or another agreement between the Recipient and FTA, or an agreement involving a principal, officer, employee, agent, or Third Party Participant of the Recipient. It also applies to subcontractors at any tier. Knowledge, as used in this paragraph, includes, but is not limited to, knowledge of a criminal or civil investigation by a Federal, state, or local law enforcement or other investigative agency, a criminal indictment or civil complaint, or probable cause that could support a criminal indictment, or any other credible information in the possession of the Recipient.

PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS AND RELATED ACTS

The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose

the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. chapter 53, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5323(l) on the Contractor, to the extent the Federal Government deems appropriate.

The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT.

a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:

- 1) Procure or obtain covered telecommunications equipment or services;
- 2) Extend or renew a contract to procure or obtain covered telecommunications equipment or services; or
- 3) Enter into a contract (or extend or renew a contract) to procure or obtain covered telecommunications equipment or services.

(b) As described in section 889 of Public Law 115-232, "covered telecommunications equipment or services" means any of the following:

(1) Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities);

(2) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities);

(3) Telecommunications or video surveillance services provided by such entities or using such equipment;

(4) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country;

(c) For the purposes of this section, "covered telecommunications equipment or services" also include systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system.

(d) In implementing the prohibition under section 889 of Public Law 115-232, heads of executive agencies administering loan, grant, or subsidy programs must prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably

necessary for those affected entities to transition from covered telecommunications equipment or services, to procure replacement equipment or services, and to ensure that communications service to users and customers is sustained.

(e) When the recipient or subrecipient accepts a loan or grant, it is certifying that it will comply with the prohibition on covered telecommunications equipment and services in this section. The recipient or subrecipient is not required to certify that funds will not be expended on covered telecommunications equipment or services beyond the certification provided upon accepting the loan or grant and those provided upon submitting payment requests and financial reports.

(f) For additional information, see section 889 of Public Law 115-232 and 200.471.

PROMPT PAYMENT

(Does not apply to projects fully funded by the Tribal Transportation Program (TTP).)

The contractor is required to pay its subcontractors performing work related to this contract for satisfactory performance of that work no later than 30 days after the contractor's receipt of payment for that work. In addition, the contractor is required to return any retainage payments to those subcontractors within 30 days after the subcontractor's work related to this contract is satisfactorily completed.

RESTRICTIONS ON LOBBYING

Conditions on use of funds.

(a) No appropriated funds may be expended by the recipient of a Federal contract, grant, loan, or cooperative agreement to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(b) Each person who requests or receives from an agency a Federal contract, grant, loan, or cooperative agreement shall file with that agency a certification, that the person has not made, and will not make, any payment prohibited by paragraph (a) of this section.

(c) Each person who requests or receives from an agency a Federal contract, grant, loan, or a cooperative agreement shall file with that agency a disclosure form if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under paragraph (a) of this section if paid for with appropriated funds.

(d) Each person who requests or receives from an agency a commitment providing for the United States to insure or guarantee a loan shall file with that agency a statement, whether that person has made or has agreed to make any payment to influence or attempt to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with that loan insurance or guarantee.

(e) Each person who requests or receives from an agency a commitment providing for the United States to insure or guarantee a loan shall file with that agency a disclosure form if that person has made or has agreed to make any payment to influence or attempt to influence an officer or employee

of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with that loan insurance or guarantee.

Certification and disclosure.

Each person shall file a certification, and a disclosure form, if required, with each submission that initiates agency consideration of such person for:

- (1) Award of a Federal contract, grant, or cooperative agreement exceeding \$100,000; or
- (2) An award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000.

(b) Each person shall file a certification, and a disclosure form, if required, upon receipt by such person of:

- (1) A Federal contract, grant, or cooperative agreement exceeding \$100,000; or
- (2) A Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding \$150,000,

Unless such person previously filed a certification, and a disclosure form, if required, under paragraph (a) of this section.

(c) Each person shall file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under paragraphs (a) or (b) of this section. An event that materially affects the accuracy of the information reported includes:

- (1) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or
- (2) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or,
- (3) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(d) Any person who requests or receives from a person referred to in paragraphs (a) or (b) of this section:

- (1) A subcontract exceeding \$100,000 at any tier under a Federal contract;
- (2) A subgrant, contract, or subcontract exceeding \$100,000 at any tier under a Federal grant;
- (3) A contract or subcontract exceeding \$100,000 at any tier under a Federal loan exceeding \$150,000; or,
- (4) A contract or subcontract exceeding \$100,000 at any tier under a Federal cooperative agreement,

Shall file a certification, and a disclosure form, if required, to the next tier above.

(e) All disclosure forms, but not certifications, shall be forwarded from tier to tier until received by the person referred to in paragraphs (a) or (b) of this section. That person shall forward all disclosure forms to the agency.

(f) Any certification or disclosure form filed under paragraph (e) of this section shall be treated as a material representation of fact upon which all receiving tiers shall rely. All liability arising from an erroneous representation shall be borne solely by the tier filing that representation and shall not be shared by any tier to which the erroneous representation is forwarded. Submitting an erroneous certification or disclosure constitutes a failure to file the required certification or disclosure,

respectively. If a person fails to file a required certification or disclosure, the United States may pursue all available remedies, including those authorized by section 1352, title 31, U.S. Code.

(g) For awards and commitments in process prior to December 23, 1989, but not made before that date, certifications shall be required at award or commitment, covering activities occurring between December 23, 1989, and the date of award or commitment. However, for awards and commitments in process prior to the December 23, 1989 effective date of these provisions, but not made before December 23, 1989, disclosure forms shall not be required at time of award or commitment but shall be filed within 30 days.

(h) No reporting is required for an activity paid for with appropriated funds if that activity is allowable under either subpart B or C.

SAFE OPERATION OF MOTOR VEHICLES

Seat Belt Use

The Contractor is encouraged to adopt and promote on-the-job seat belt use policies and programs for its employees and other personnel that operate company-owned vehicles, company rented vehicles, or personally operated vehicles. The terms "company-owned" and "company-leased" refer to vehicles owned or leased either by the Contractor or Agency.

Distracted Driving

The Contractor agrees to adopt and enforce workplace safety policies to decrease crashes caused by distracted drivers, including policies to ban text messaging while using an electronic device supplied by an employer, and driving a vehicle the driver owns or rents, a vehicle Contractor owns, leases, or rents, or a privately-owned vehicle when on official business in connection with the work performed under this Contract.

SEISMIC SAFETY

The contractor agrees that any new building or addition to an existing building will be designed and constructed in accordance with the standards for Seismic Safety required in Department of Transportation (DOT) Seismic Safety Regulations 49 C.F.R. part 41 and will certify to compliance to the extent required by the regulation. The contractor also agrees to ensure that all work performed under this contract, including work performed by a subcontractor, is in compliance with the standards required by the Seismic Safety regulations and the certification of compliance issued on the project.

SIMPLIFIED ACQUISITION THRESHOLD

Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. § 1908, or otherwise set by law, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate. (Note that the simplified acquisition threshold determines the procurement procedures that must be employed pursuant to 2 C.F.R. §§ 200.317–200.327.

The simplified acquisition threshold does not exempt a procurement from other eligibility or processes requirements that may apply. For example, Buy America's eligibility and process requirements apply to any procurement in excess of \$150,000. 49 U.S.C. § 5323(j)(13).

SOLID WASTES (RECOVERED MATERIALS)

(a) A Recipient or subrecipient that is a State agency or agency of a political subdivision of a State and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 as amended, 42 U.S.C. 6962. The requirements of Section 6002 include procuring only items designated in the guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

(b) The recipient or subrecipient should, to the greatest extent practicable and consistent with law, purchase, acquire, or use products and services that can be reused, refurbished, or recycled; contain recycled content, are biobased, or are energy and water efficient; and are sustainable. This may include purchasing compostable items and other products and services that reduce the use of single-use plastic products. See Executive Order 14057, section 101, Policy.

SPECIAL NOTIFICATION REQUIREMENTS FOR STATES

Applies to States –

a. To the extent required under federal law, the State, as the Recipient, agrees to provide the following information about federal assistance awarded for its State Program, Project, or related activities:

- (1) The Identification of FTA as the federal agency providing the federal assistance for a State Program or Project;
- (2) The Catalog of Federal Domestic Assistance Number of the program from which the federal assistance for a State Program or Project is authorized; and
- (3) The amount of federal assistance FTA has provided for a State Program or Project.

b. Documents - The State agrees to provide the information required under this provision in the following documents:

- (1) applications for federal assistance,
- (2) requests for proposals or solicitations,
- (3) forms,
- (4) notifications,
- (5) press releases,
- (6) other publications.

TERMINATION

Termination for Convenience (General Provision)

The Agency may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in the Agency's best interest. The Contractor shall be paid its costs, including contract close-out costs, and profit on work performed up to the time of termination. The Contractor shall promptly submit its termination claim to Agency to be paid the Contractor. If the Contractor has any property in its possession belonging to Agency, the Contractor will account for the same, and dispose of it in the manner Agency directs.

Termination for Default [Breach or Cause] (General Provision)

If the Contractor does not deliver supplies in accordance with the contract delivery schedule, or if the contract is for services, the Contractor fails to perform in the manner called for in the contract, or if

the Contractor fails to comply with any other provisions of the contract, the Agency may terminate this contract for default. Termination shall be effected by serving a Notice of Termination on the Contractor setting forth the manner in which the Contractor is in default. The Contractor will be paid only the contract price for supplies delivered and accepted, or services performed in accordance with the manner of performance set forth in the contract. If it is later determined by the Agency that the Contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the Contractor, the Agency, after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a Termination for Convenience.

Opportunity to Cure (General Provision)

The Agency, in its sole discretion may, in the case of a termination for breach or default, allow the Contractor [an appropriately short period of time] in which to cure the defect. In such case, the Notice of Termination will state the time period in which cure is permitted and other appropriate conditions

If Contractor fails to remedy to Agency's satisfaction the breach or default of any of the terms, covenants, or conditions of this Contract within [10 days] after receipt by Contractor of written notice from Agency setting forth the nature of said breach or default, Agency shall have the right to terminate the contract without any further obligation to Contractor. Any such termination for default shall not in any way operate to preclude Agency from also pursuing all available remedies against Contractor and its sureties for said breach or default.

Waiver of Remedies for any Breach

In the event that Agency elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this contract, such waiver by Agency shall not limit Agency's remedies for any succeeding breach of that or of any other covenant, term, or condition of this contract.

Termination for Convenience (Professional or Transit Service Contracts)

The Agency, by written notice, may terminate this contract, in whole or in part, when it is in the Agency's interest. If this contract is terminated, the Agency shall be liable only for payment under the payment provisions of this contract for services rendered before the effective date of termination.

Termination for Default (Supplies and Service)

If the Contractor fails to deliver supplies or to perform the services within the time specified in this contract or any extension, or if the Contractor fails to comply with any other provisions of this contract, the Agency may terminate this contract for default. The Agency shall terminate by delivering to the Contractor a Notice of Termination specifying the nature of the default. The Contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner or performance set forth in this contract. If, after termination for failure to fulfill contract obligations, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Agency.

Termination for Default (Transportation Services)

If the Contractor fails to pick up the commodities or to perform the services, including delivery services, within the time specified in this contract or any extension, or if the Contractor fails to comply with any other provisions of this contract, the Agency may terminate this contract for default. The Agency shall terminate by delivering to the Contractor a Notice of Termination specifying the nature of default. The Contractor will only be paid the contract price for services performed in accordance with the manner of performance set forth in this contract.

If this contract is terminated while the Contractor has possession of Agency goods, the Contractor shall, upon direction of the Agency, protect and preserve the goods until surrendered to the Agency or its agent. The Contractor and Agency shall agree on payment for the preservation and protection of goods.

Failure to agree on an amount will be resolved under the Dispute clause.

If, after termination for failure to fulfill contract obligations, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Agency.

Termination for Default (Construction)

If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will ensure its completion within the time specified in this contract or any extension or fails to complete the work within this time, or if the Contractor fails to comply with any other provision of this contract, Agency may terminate this contract for default. The Agency shall terminate by delivering to the Contractor a Notice of Termination specifying the nature of the default. In this event, the Agency may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Agency resulting from the Contractor's refusal or failure to complete the work within specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Agency in completing the work.

The Contractor's right to proceed shall not be terminated nor shall the Contractor be charged with damages under this clause if: 1. The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include: acts of God, acts of Agency, acts of another contractor in the performance of a contract with Agency, epidemics, quarantine restrictions, strikes, freight embargoes; and 2. The Contractor, within [10] days from the beginning of any delay, notifies Agency in writing of the causes of delay. If, in the judgment of Agency, the delay is excusable, the time for completing the work shall be extended. The judgment of Agency shall be final and conclusive for the parties, but subject to appeal under the Disputes clause(s) of this contract. 3. If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of Agency.

Termination for Convenience or Default (Architect and Engineering)

The Agency may terminate this contract in whole or in part, for the Agency's convenience or because of the failure of the Contractor to fulfill the contract obligations. The Agency shall terminate by delivering to the Contractor a Notice of Termination specifying the nature, extent, and effective date of the termination. Upon receipt of the notice, the Contractor shall (1) immediately discontinue all services affected (unless the notice directs otherwise), and (2) deliver to the Agency's Contracting Officer all data, drawings, specifications, reports, estimates, summaries, and other information and materials accumulated in performing this contract, whether completed or in process. Agency has a royalty-free, nonexclusive, and irrevocable license to reproduce, publish or otherwise use, all such data, drawings, specifications, reports, estimates, summaries, and other information and materials.



If the termination is for the convenience of the Agency, the Agency's Contracting Officer shall make an equitable adjustment in the contract price but shall allow no anticipated profit on unperformed services.

If the termination is for failure of the Contractor to fulfill the contract obligations, the Agency may complete the work by contract or otherwise and the Contractor shall be liable for any additional cost incurred by the Agency.

If, after termination for failure to fulfill contract obligations, it is determined that the Contractor was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of Agency

Termination for Convenience or Default (Cost-Type Contracts)

The Agency may terminate this contract, or any portion of it, by serving a Notice of Termination on the Contractor. The notice shall state whether the termination is for convenience of Agency or for the default of the Contractor. If the termination is for default, the notice shall state the manner in which the Contractor has failed to perform the requirements of the contract. The Contractor shall account for any property in its possession paid for from funds received from the Agency, or property supplied to the Contractor by the Agency. If the termination is for default, the Agency may fix the fee, if the contract provides for a fee, to be paid the Contractor in proportion to the value, if any, of work performed up to the time of termination. The Contractor shall promptly submit its termination claim to the Agency and the parties shall negotiate the termination settlement to be paid the Contractor.

If the termination is for the convenience of Agency, the Contractor shall be paid its contract close-out costs, and a fee, if the contract provided for payment of a fee, in proportion to the work performed up to the time of termination.

If, after serving a Notice of Termination for Default, the Agency determines that the Contractor has an excusable reason for not performing, the Agency, after setting up a new work schedule, may allow the Contractor to continue work, or treat the termination as a Termination for Convenience.

VETERANS HIRING PREFERENCE

Veterans Employment - Construction contracts of Federal financial assistance shall ensure that contractors working on a capital project funded using such assistance give a hiring preference, to the extent practicable, to veterans (as defined in section 2108 of title 5) who have the requisite skills and abilities to perform the construction work required under the contract. This subsection shall not be understood, construed or enforced in any manner that would require an employer to give a preference to any veteran over any equally qualified applicant who is a member of any racial or ethnic minority, female, an individual with a disability, or a former employee.

VIOLATION AND BREACH OF CONTRACT

Disputes:

Disputes arising in the performance of this Contract that are not resolved by agreement of the parties shall be decided in writing by the authorized representative of the agency. This decision shall be final and conclusive unless within [10] days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the agencies authorized representative. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the agencies authorized representative shall be binding upon the Contractor and the Contractor shall abide be the decision.

Performance during Dispute:

Unless otherwise directed by the agencies authorized representative, contractor shall continue performance under this contract while matters in dispute are being resolved.

Claims for Damages:

Should either party to the contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefore shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

Remedies:

Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the agencies authorized representative and contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the State in which the Agency is located.

Rights and Remedies:

Duties and obligations imposed by the contract documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the Agency or contractor shall constitute a waiver of any right or duty afforded any of them under the contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

CONFORMANCE WITH ITS NATIONAL ARCHITECTURE

Intelligent Transportation Systems (ITS) projects shall conform to the National ITS Architecture and standards pursuant to 23 CFR § 940. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture in support of integration and the subsequent adherence of all ITS projects to that regional ITS architecture. Development of the regional ITS architecture should be consistent with the transportation planning process for Statewide and Metropolitan Transportation Planning (49 CFR Part 613 and 621).

FEDERAL TAX LIABILITY AND RECENT FELONY CONVICTIONS

(1) The contractor certifies that it:

- (a) Does not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and
- (b) Was not convicted of the felony criminal violation under any Federal law within the preceding 24 months.

If the contractor cannot so certify, the Recipient will refer the matter to FTA and not enter into any Third Party Agreement with the Third Party Participant without FTA's written approval.

- (2) Flow-Down. The Recipient agrees to require the contractor to flow this requirement down to participants at all lower tiers, without regard to the value of any subagreement.



SEVERABILITY

The Contractor agrees that if any provision of this agreement or any amendment thereto is determined to be invalid, then the remaining provisions thereof that conform to federal laws, regulations, requirements, and guidance will continue in effect.

TRAFFICKING IN PERSONS

The contractor agrees that it and its employees that participate in the Recipient's Award, may not:

- a. Engage in severe forms of trafficking in persons during the period of time that the Recipient's Award is in effect;
- b. Procure a commercial sex act during the period of time that the Recipient's Award is in effect; or
- c. Use forced labor in the performance of the Recipient's Award or subagreements thereunder.

Signature confirms you have read, understand, and agree to the clauses listed herein.

Signature

Date

Name

Title



Breaches & Dispute Resolutions

Disputes. Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the authorized representative of the LRTA's Administrator. This decision shall be final and conclusive unless within five days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the Administrator. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the Administrator shall be binding upon the Contractor and the Contractor shall abide by the decision.

Performance During Dispute. Unless otherwise directed by LRTA, Contractor shall continue performance under this Contract while matters in dispute are being resolved.

Claims for Damages. Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of his employees, agents or others for whose acts he is legally liable, a claim for damages therefor shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

Remedies. Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between the LRTA and the Contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the Commonwealth of Massachusetts.

Rights and Remedies. The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by the LRTA, the Architect or Contractor shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

Signature:

Date



Request & Appeal Procedures

Changes in specifications: Changes to the Bid/Proposal documents and specifications will only be made by written addendum, and all proposers/bidders will be notified if any changes are made. It is the responsibility of the bidder to ascertain if all addendum have been received prior to the submission of the Bid.

Requests for changes, clarification and approved equals of the Bid/Proposal documents, specifications and requirements must be received by the LRTA in writing no later than the deadline for written requests for changes, clarifications and/or approved equals that is listed on the "Procurement Schedule" (unless changed by a formal written addendum issued by the LRTA).

The LRTA intends to reply in writing to any properly received request for changes, clarifications or approved equals to the Proposal/Bid documents, specifications or requirements no later than five days prior to due date of Proposal/Bid receipt.

The LRTA reserves the right to postpone the Proposal/Bid opening for its convenience and to reject any and all Proposals/Bids.

Appeal from the decision of the LRTA must be in writing to the LRTA and if received less than four full working days before bid opening then it will not be considered.

Signature:_____

Date:_____



Certification Regarding Payment of Prevailing Wage Rates

The undersigned bidder hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the Project of wages in an amount no less than the applicable prevailing wage rates established for the Project by the Massachusetts Department of Labor and Industries and the Federal Davis-Bacon wage rates. Where either rates may conflict, the higher of the two rates will be applied to any applicable trades or labor class.

The undersigned bidder agrees to indemnify the Lowell Regional Transit Authority (the awarding authority) for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection with any delay or stoppage of the Project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, if selected as the Contractor, to pay laborers employed in the Project said applicable prevailing wage rates.

Dated: _____ Name of Bidder: _____

Signature: _____



Certification of Similar Projects

This form is to certify 3 projects completed by the Bidder of similar scope, cost, and size.

<u>Project #1</u>	<u>Project # 2</u>	<u>Project #3</u>
Project owner: _____ _____	Project owner: _____ _____	Project owner: _____ _____
Date(s): _____	Date(s): _____	Date(s): _____
Project Cost: _____ _____	Project Cost: _____ _____	Project Cost: _____ _____
Generator Size: _____ _____	Generator Size: _____ _____	Generator Size: _____ _____
<u>REFERENCE FOR PROJECT</u>	<u>REFERENCE FOR PROJECT</u>	<u>REFERENCE FOR PROJECT</u>
Name: _____ _____	Name: _____ _____	Name: _____ _____
Email: _____ _____	Email: _____ _____	Email: _____ _____
Phone: _____ _____	Phone: _____ _____	Phone: _____ _____

Signature

Title

Date



Federal Wage Rates

ATTACHED ON FOLLOWING PAGES

"General Decision Number: MA20260001 05/18/2026

State: Massachusetts

Construction Types: Building

Counties: Massachusetts Counties of
Barnstable, Bristol, Dukes, Essex,
Middlesex, Nantucket, Norfolk and
Suffolk

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ASBE0006-001 09/01/2024	Rates	Fringes
INSULATOR/ASBESTOS WORKER (ZONE B) ZONE B- BARNSTABLE COUNTY (BARNSTABLE, BOURNE, FALMOUTH, MASHPEE, SANDWICH), BRISTOL COUNTY (ALL CITIES EXCEPT EASTON),AND NORFOLK COUNTY (BELLINGHAM, FRANKLIN, PLAINVILLE).....	\$ 55.45	36.63
INSULATOR/ASBESTOS WORKER (ZONE A) ZONE A- BARNSTABLE COUNTY (BREWSTER, CHATHAM, DENNIS, EASTHAM, HARWICH, ORLEANS, PROVINCETOWN, TRURO, WELLFLEET, YARMOUTH) BRISTOL COUNTY (EASTON), MIDDLESEX COUNTY, AND NORFOLK COUNTY (AVON, BRAINTREE, BROOKLINE, CANTON, COHASSET, DEDHAM, DOVER, FOXBOROUGH, HOLBROOK, MEDFIELD, MEDWAY, MILLIS, MILTON, NEEDHAM, NORFOLK, NORWOOD, QUINCY, RANDOLPH, SHARON, STOUGHTON, WALPOLE, WELLESLEY, WESTWOOD, WEYMOUTH).....	\$ 55.45	36.63

ASBE0006-002 09/01/2024	Rates	Fringes
HAZARDOUS MATERIAL HANDLER: INCLUDES PREPARATION, WETTING, STRIPPING, REMOVAL, SCRAPPING, VACUUMING, BAGGING AND DISPOSING OF ALL INSULATION MATERIALS FROM MECHANICAL SYSTEMS WHETHER THEY CONTAIN ASBESTOS OR NOT (BARNSTABLE (BREWSTER, CHATHAM, DENNIS, EASTHAM, HARWICH, ORLEANS, PROVINCETOWN, TRURO, WELLFLEET AND YARMOUTH); BRISTOL (EASTON); ESSEX; MIDDLESEX; NORFOLK (AVON, BRAINTREE, BROOKLINE, CANTON, COHASSET, DEDHAM, DOVER, FOXBORO, HOLBROOK, HULL, MEDFIELD, MEDWAY, MILLIS, MILTON, NEEDHA.....	\$ 55.45	36.63

ASBE0006-010 09/01/2024	Rates	Fringes
INSULATOR/ASBESTOS WORKER: INCLUDES THE APPLICATION OF ALL INSULATING MATERIALS, PROTECTIVE COVERINGS, COATINGS AND FINISHES TO ALL TYPES OF MECHANICAL		

SYSTEMS.....	\$ 55.45	36.63

BOIL0029-001 01/01/2025		
	Rates	Fringes
BOILERMAKER.....	\$ 50.62	28.82

BRMA0001-008 08/01/2023		
	Rates	Fringes
BRICKLAYER, CEMENT MASON, PLASTERER (FOXBORO CHAPTER BRISTOL (ATTLEBORO, BERKLEY, DIGHTON, MANSFIELD, NORTH ATTLEBORO, NORTON, RAYNHAM, REHOBOTH, SEEKONK, TAUNTON) AND NORFOLK (BELLINGHAM, CANTON, DEDHAM, FOXBORO, FRANKLIN, NORFOLK, NORWOOD, PLAINVILLE, SHARON, WALPOLE, WESTRWOOD, WRENTHAM) COUNTIES).....	\$ 60.26	33.71

BRMA0001-009 08/01/2023		
	Rates	Fringes
BRICKLAYER AND PLASTERER (LOWELL CHAPTER MIDDLESEX (ACTON, ASBY, AYER, BEDFORD, BILLERICA, BOXBORO, CARLISLE, CHEMSFORD, DRACUT, DUNSTBLE, FT. DENVENS, GROTON, LITTLETON, LOWELL, NORTH ACTON, PEPPERELL, SHIRLEY, SOUTH ACTON, TEWKSBURY, TOWNSEND, TYNGSBORO, WEST ACTON, WESTFORD, WILMINGTON)).....	\$ 60.26	33.71

BRMA0001-010 08/01/2023		
	Rates	Fringes
BRICKLAYER (LOWELL CHAPTER MIDDLESEX (ASHLAND, FRAMINGHAM, HOLLISTON, HOPKINTON, HUDSON, MAYNARD, NATICK, SHERBORN, STOW); AND NORFOLK (MEDFIELD, MEDWAY, MILLIS)).....	\$ 60.26	33.71

BRMA0003-001 08/01/2024		
	Rates	Fringes
TERRAZZO FINISHER.....	\$ 63.44	37.33
MARBLE, TILE & TERRAZZO WORKERS.....	\$ 64.52	37.51
MARBLE & TILE FINISHER.....	\$ 49.32	35.26

BRMA0003-003 08/01/2024		
	Rates	Fringes
BRICKLAYER (BOSTON CHAPTER MIDDLESEX (ARLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, SOMERVILLE); NORFOLK (BROOKLINE, MILTON); AND SUFFOLK).....	\$ 64.50	37.54

BRMA0003-006 08/01/2024		
	Rates	Fringes
BRICKLAYER, CEMENT MASON AND PLASTERER (LYNN CHAPTER ESSEX (AMESBURY, ANDOVER, BEVERLY, BOXFORD, DANVERS, ESSEX, GEORGETOWN, GLOUCESTER, GROVELAND, HAMILTON, HAVERHILL, IPSEWICH, LAWRENCE, LYNN, LYNNFIELD, MANCHESTER, MARBLEHEAD, MERRIMAC, METHUEN, MIDDLETON, NAHANT, NEWBURY, NEWBURYPORT, NORTH ANDOVER, PEABODY, ROCKPORT, ROWLEY, SALISBURY, SALEM, SAUGUS, SWAMPSCOTT, TOPSFIELD WAKEFIELD, WENHAM, WEST NEWBURY); AND MIDDLESEX (READING, NORTH READING, WAKEFIELD)).....	\$ 64.50	37.54

BRMA0003-007 08/01/2024

Rates

Fringes

BRICKLAYER AND PLASTERER (WALTHAM CHAPTER
MIDDLESEX (BELMONT, BURLINGTON, CONCORD, LEXINGTON,
LINCOLN, STONEHAM, SUDBURY, WALTHAM, WATERTOWN,
WAYLAND, WESTON, WINCHESTER, WOBURN)).....\$ 64.50

37.54

BRMA0003-008 08/01/2024

Rates

Fringes

BRICKLAYER, CEMENT MASON AND PLASTERER (NEWTON
CHAPTER MIDDLESEX (NEWTON) AND NORFOLK (DOVER,
NEEDHAM, WELLESLEY)).....\$ 64.50

37.54

BRMA0003-009 08/01/2024

Rates

Fringes

BRICKLAYER, CEMENT MASON AND PLASTERER (NEW BEDFORD
BARNSTABLE; BRISTOL (ACUSHNET, DARMOUTH,
FARHAVEN, FALL RIVER, FREETOWN, NEW BEDFORD,
SOMERSET, SWANSEA, WESTPORT); DUKES; AND NANTUCKET
COUNTIES).....\$ 64.50

37.54

BRMA0003-010 08/01/2024

Rates

Fringes

BRICKLAYER, CEMENT MASON AND PLASTERER (QUINCY
CHAPTER NORFOLK COUNTY (AVON, BRAINTREE, COHASSET,
HOLBROOK, QUINCY, RANDOLPH, SOUGHTON, WEYMOUTH))...\$ 64.50

37.54

CARP0056-011 08/01/2024

Rates

Fringes

PILEDRIVERMAN (SUFFOLK (ALL OF COUNTY); AND THOSE
AREAS OF BARNSTABLE, BRISTOL, ESSEX, MIDDLESEX &
NORFOLK COUNTIES SITUATED INSIDE BOSTON BELTWAY
(I-495) AND NORTH OF CAPE COD CANAL. ALL OF DUKES
AND NANTUCKET COUNTIES).....\$ 55.79

35.47

CARP0056-012 08/01/2024

Rates

Fringes

PILEDRIVERMAN (THE AREAS OF BARNSTABLE, BRISTOL,
AND NORFOLK COUNTIES SITUATED OUTSIDE BOSTON
BELTWAY (I-495) AND SOUTH OF CAPE COD CANAL).....\$ 55.79

35.47

CARP0056-013 08/01/2024

Rates

Fringes

PILEDRIVERMAN (THOSE AREAS OF ESSEX AND MIDDLESEX
COUNTIES SITUATED OUTSIDE BOSTON BELTWAY (I-495))...\$ 49.19

35.47

CARP0327-001 09/01/2025

Rates

Fringes

CARPENTER (MIDDLESEX (BELMONT, CAMBRIDGE, EVERETT,
MALDEN, MEDFORD, SOMERVILLE); NORFOLK (BROOKLINE,
DEDHAM, MILTON); AND SUFFOLK).....\$ 61.19

31.55

CARP0339-001 09/01/2025

Rates

Fringes

CARPENTER (BRISTOL (ATTLEBOROUGH, NORTH

ATTLEBOROUGH); ESSEX; MIDDLESEX (EXCEPT BELMONT, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, SOMERVILLE); AND NORFOLK (BELLINGHAM, CANTON, FOXBORO, FRANKLIN, MEDFIELD, MEDWAY, MILLIS, NEEDHAM, NORFOLK, NORWOOD, PLAINVILLE, SHARON, WALPOLE, WELLESLEY, WESTWOOD, WRENTHAM)).....\$ 50.10	31.45

CARP0346-003 09/01/2025	
	Rates Fringes
CARPENTER (NORFOLK COUNTY (BRAintree, COHASSETT, SCITUATE, WEYMOUTH, QUINCY)).....\$ 50.10	31.45

CARP0624-005 09/01/2017	
	Rates Fringes
CARPENTER (DUKES; NANTUCKET).....\$ 46.43	28.35

CARP0624-007 09/01/2017	
	Rates Fringes
CARPENTER (BARNSTABLE; BRISTOL (EXCEPT ATTLEBORO & NORTH ATTLEBORO); AND NORFOLK (AVON, HOLBROOK, RANDOLPH, STOUGHTON) COUNTIES).....\$ 39.28	27.90

CARP1121-001 04/21/2025	
	Rates Fringes
MILLWRIGHT (SUFFOLK COUNTY).....\$ 50.47	33.50

CARP1121-003 04/21/2025	
	Rates Fringes
MILLWRIGHT (BARNSTABLE, BRISTOL, DUKES, ESSEX, MIDDLESEX, NANTUCKET AND NORFOLK COUNTIES).....\$ 45.03	33.25

CARP2168-001 09/01/2025	
	Rates Fringes
FLOOR LAYER: CARPET (MIDDLESEX (BELMONT, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, SOMERVILLE); NORFOLK (BROOKLINE, DEDHAM, MILTON); AND SUFFOLK)...\$ 57.49	31.75

CARP2168-004 09/01/2025	
	Rates Fringes
FLOOR LAYER: CARPET (BRISTOL; ESSEX; MIDDLESEX (EXCEPT BELMONT, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, SOMERVILLE); REMAINDER OF NORFOLK COUNTY)..\$ 57.49	31.75

CARP2168-005 09/01/2025	
	Rates Fringes
FLOOR LAYER: CARPET (BARNSTABALE; DUKES; AND NANTUCKET).....\$ 49.18	31.75

ELEC0096-001 09/07/2025	
	Rates Fringes
TELEDATA SYSTEM INSTALLER (MIDDLESEX (ASHBY, ASHLAND, AYER, FT. DEVENS, GROTON, HOPKINTON, HUDSON, MARLBORO, PEPPERELL, SHIRLEY, STOW, TOWNSEND)).....\$ 36.12	34.51

ELECTRICIAN (MIDDLESEX (ASHBY, ASHLAND, AYER, FT. DEVENS, GROTON, HOPKINTON, HUDSON, MARLBORO,	

PEPPERELL, SHIRLEY, STOW, TOWNSEND)).....\$ 48.16 36.20

ELEC0099-001 06/01/2025

Rates

Fringes

TELEDATA SYSTEM INSTALLER (BRISTOL (ATTLEBORO,
NORTH ATTLEBORO, SEEKONK)).....\$ 42.09 19.71
ELECTRICIAN (BRISTOL (ATTLEBORO, NORTH ATTLEBORO,
SEEKONK)).....\$ 56.11 24.74

ELEC0103-001 09/01/2025

Rates

Fringes

TELEDATA SYSTEM INSTALLER (ESSEX; MIDDLESEX
(EXCLUDING ASHBY, ASHLAND, AYER, FT. DEVENS,
GROTON, HOPKINTON, HUDSON, MARLBORO, PEPPERELL,
SHIRLEY, STOW, TOWNSEND); NORFOLK (EXCLUDING AVON,
HOLBROOK, PLAINVILLE, RANDOLPH, STOUGHTON) SUFFOLK).\$ 52.94 34.74

ELEC0103-002 09/01/2025

Rates

Fringes

ELECTRICIAN (ESSEX (AMESBURY, ANDOVER, BOXFORD,
GEORGETOWN, GROVELAND, HAVERHILL, LAWRENCE,
MERRIMAC, METHUEN, NEWBURY, NEWBURYPORT, NORTH
ANDOVER, ROWLEY, SALISBURY, WEST NEWBURY);
MIDDLESEX (BEDFORD, BILLERICA, BOXBORO, BURLINGTON,
CARLISLE, CHELMSFORD, DRACUT, DUNSTABLE LITTLETON,
LOWELL, NORTH READING, TEWKSBURY, TYNGSBORO,
WESTFORD, WILMINGTON)).....\$ 66.17 37.08

ELEC0103-004 09/01/2025

Rates

Fringes

ELECTRICIAN (ESSEX (BEVERLY, DANVERS, ESSEX,
GLOUCESTER, HAMILTON, IPSWICH, MANCHESTER,
MARBLEHEAD, MIDDLETON, PEABODY, ROCKPORT, SALEM,
TOPSFIELD, WENHAM)).....\$ 66.17 37.08

ELEC0103-005 09/01/2025

Rates

Fringes

ELECTRICIAN (ESSEX (LYNN, LYNNFIELD, NAHANT,
SAUGUS, SWAMPSCOTT); MIDDLESEX (ACTON, ARLINGTON,
BELMONT, CAMBRIDGE, CONCORD, EVERETT, FRAMINGHAM,
HOLLISTON, LEXINGTON, LINCOLN, MALDEN, MAYNARD,
MEDFORD, MELROSE, NATICK, NEWTON, READING,
SHERBORN, SOMERVILLE, STONEHAM, SUDBURY, WAKEFIELD,
WALTHAM, WATERTOWN, WAYLAND, WESTON, WINCHESTER,
WOBURN); NORFOLK (BELLINGHAM, BRAINTREE, BROOKLINE,
CANTON, COHASSET, DEDHAM, DOVER, FOXBORO,
FRANKLOIN, MEDFIELD, MEDWAY, MILLIS, MILTON,
NEEDHAM, NORFOLK, NORWO.....\$ 66.17 37.08

ELEC0104-001 09/01/2024

Rates

Fringes

LINE CONSTRUCTION: LINEMAN A. PAID HOLIDAYS:
NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY;
LABOR DAY; THANKSGIVING DAY; CHRISTMAS DAY AND
COLUMBUS DAY, PROVIDED THE EMPLOYEE HAS BEEN
EMPLOYED 5 WORKING DAYS PRIOR TO ANY ONE OF THE
LISTED HOLIDAYS.....\$ 58.41 30.19
LINE CONSTRUCTION: GROUNDMAN A. PAID HOLIDAYS:
NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY;

LABOR DAY; THANKSGIVING DAY; CHRISTMAS DAY AND COLUMBUS DAY, PROVIDED THE EMPLOYEE HAS BEEN EMPLOYED 5 WORKING DAYS PRIOR TO ANY ONE OF THE LISTED HOLIDAYS.....	\$ 32.13	12.70
LINE CONSTRUCTION: EQUIPMENT OPERATOR A. PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; CHRISTMAS DAY AND COLUMBUS DAY, PROVIDED THE EMPLOYEE HAS BEEN EMPLOYED 5 WORKING DAYS PRIOR TO ANY ONE OF THE LISTED HOLIDAYS.....		
	\$ 49.65	26.72
LINE CONSTRUCTION: CABLEMAN A. PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; THANKSGIVING DAY; CHRISTMAS DAY AND COLUMBUS DAY, PROVIDED THE EMPLOYEE HAS BEEN EMPLOYED 5 WORKING DAYS PRIOR TO ANY ONE OF THE LISTED HOLIDAYS.....		
	\$ 58.41	30.19

ELEC0223-005 09/01/2024

Rates

Fringes

ELECTRICIAN (BARNSTABLE; BRISTOL (EXCEPT ATTLEBORO, NORTH ATTLEBORO, SEEKONK); DUKES; NANTUCKET AND NORFOLK (AVON, HALBROOK, PLAINVILLE, RANDOLPH, STOUGHTON)).....	\$ 50.02	31.05
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ELEC0223-006 09/01/2024

Rates

Fringes

TELEDATA SYSTEM INSTALLER (BARNSTABLE; BRISTOL (EXCEPT ATTLEBORO, NORTH ATTLEBORO, SEEKONK); DUKES; NANTUCKET AND NORFOLK (AVON, HALBROOK, PLAINVILLE, RANDOLPH, STOUGHTON)).....	\$ 42.52	28.47
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ELEV0004-001 01/01/2025

Rates

Fringes

ELEVATOR MECHANIC FOOTNOTE FOR ELEVATOR MECHANICS: A.VACATION: 6%/UNDER 5 YEARS BASED ON REGULAR HOURLY RATE FOR ALL HOURS WORKED. 8%/OVER 5 YEARS BASED ON REGULAR HOURLY RATE FOR ALL HOURS WORKED. B. PAID HOLIDAYS: NEW YEAR'S DAY; MEMORIAL DAY; INDEPENDENCE DAY; LABOR DAY; VETERANS' DAY; THANKSGIVING DAY; THE FRIDAY AFTER THANKSGIVING DAY; AND CHRISTMAS DAY.....	\$ 74.17	38.44
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ENGI0004-001 06/01/2025

Rates

Fringes

POWER EQUIPMENT OPERATORS: GROUP 6 OILER (ON TRUCK CRANES AND GRADALLS) STANT ENGINEER (ON TRUCK CRANE AND GRADALL) FOOTNOTE FOR POWER EQUIPMENT OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY, INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY HOURLY PREMIUM FOR BOOM LENGTHS (INCLUDING JIB): OVER 150 FT. +2.28 OVER 185 FT. +4.05 OVER 210 FT. +5.67 OVER 250 FT. +8.59 OVER 295 FT. +11.86 OVER 350 FT. +13.82.....	\$ 30.85	33.70
POWER EQUIPMENT OPERATORS: GROUP 5 OILER (OTHER THAN TRUCK CRANES AND GRADALLS) FOOTNOTE FOR POWER EQUIPMENT OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY, INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY,		

CHRISTMAS DAY HOURLY PREMIUM FOR BOOM LENGTHS
 (INCLUDING JIB): OVER 150 FT. +2.28 OVER
 185 FT. +4.05 OVER 210 FT. +5.67 OVER 250
 FT. +8.59 OVER 295 FT. +11.86 OVER 350 FT.
 +13.82.....\$ 25.02 33.70

POWER EQUIPMENT OPERATORS: GROUP 4 ASSISTANT
 ENGINEER (FIREMAN) FOOTNOTE FOR POWER EQUIPMENT
 OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY,
 WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY,
 INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY,
 VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY
 HOURLY PREMIUM FOR BOOM LENGTHS (INCLUDING JIB):
 OVER 150 FT. +2.28 OVER 185 FT. +4.05
 OVER 210 FT. +5.67 OVER 250 FT. +8.59
 OVER 295 FT. +11.86 OVER 350 FT. +13.82.....\$ 46.52 33.70

POWER EQUIPMENT OPERATORS: GROUP 3 PUMPS (1-3
 GROUPED); COMPRESSOR; WELDING MACHINE (1-3
 GROUPED); GENERATOR; CONCRETE VIBRATOR; HEATER
 (POWER DRIVEN 1- 5); WELL POINT SYSTEM (OPERATING);
 SYPHON-PULSOMETER; CONCRETE MIXER; VALVES
 CONTROLLING PERMANENT PLANT AIR OR STEAM; CONVEYOR;
 JACKSON TYPE TAMPER; SINGLE DIAPHRAGM PUMP;
 LIGHTING PLANT FOOTNOTE FOR POWER EQUIPMENT
 OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY,
 WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY,
 INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY,
 VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY
 HOURLY PREMIUM FOR BOOM LENGTHS (INCLUDING JIB):
 OVER 150 FT. +2.28 OVER 185 FT. +4.05
 OVER 210 FT. +5.67 OVER 250 FT. +8.59
 OVER 295 FT. +11.86 OVER 350 FT. +13.82.....\$ 37.02 33.70

POWER EQUIPMENT OPERATORS: GROUP 2 SONIC OR
 VIBRATORY HAMMER; GRADER; SCRAPER; TANDEM SCRAPER;
 CONCRETE PUMP; BULLDOZER; TRACTOR; YORK RAKE;
 MULCHING MACHINE; PORTABLE STEAM BOILER; PORTABLE
 STEAM GENERATOR; ROLLER; SPREADER; TAMPER (SELF
 PROPELLED OR TRACTOR DRAWN); ASPHALT PAVER;
 MECHANIC - MAINTENANCE; PAVING SCREED MACHINE;
 STATIONARY STEAM BOILER; PAVING CONCRETE FINISHING
 MACHINE; CAL TRUCK; BALLAST REGULATOR; SWITCH
 TAMPER; RAIL ANCHOR MACHINE; TIRE TRUCK FOOTNOTE
 FOR POWER EQUIPMENT OPERATORS: A. PAID HOLIDAYS:
 NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, LABOR DAY,
 MEMORIAL DAY, INDEPENDENCE DAY, PATRIOT'S DAY,
 COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY,
 CHRISTMAS DAY HOURLY PREMIUM FOR BOOM LENGTHS
 (INCLUDING JIB): OVER 150 FT. +2.28 OVER
 185 FT. +4.05 OVER 210 FT. +5.67 OVER 250
 FT. +8.59 OVER 295 FT. +11.86 OVER 350 FT.
 +13.82.....\$ 57.18 33.70

POWER EQUIPMENT OPERATORS: GROUP 1 CRANE; SHOVEL;
 TRUCK CRANE; CHERRY PICKER; DRAGLINE; TRENCH HOE;
 BACKHOE; THREE DRUM MACHINE; DERRICK; PILE DRIVER;
 ELEVATOR TOWER; HOIST; GRADALL; SHOVEL DOZER; FRONT
 END LOADER; FORK LIFT; SUGER; BORING MACHINE;
 ROTARYU DRILL; POST HOLE HAMMER; POST HOLE DIGGER;
 PUMPCRETE MACHINE; ASPHALT PLANT (ON SITE);
 CONCRETE BATCHING AND/OR MIXING PLANT (ON SITE);
 CRUSHER PLANT (ON SITE); PAVING CONCRETE MIXER;
 TIMBER JACK FOOTNOTE FOR POWER EQUIPMENT
 OPERATORS: A. PAID HOLIDAYS: NEW YEAR'S DAY,
 WASHINGTON'S BIRTHDAY, LABOR DAY, MEMORIAL DAY,
 INDEPENDENCE DAY, PATRIOT'S DAY, COLUMBUS DAY,
 VETERAN'S DAY, THANKSGIVING DAY, CHRISTMAS DAY
 HOURLY PREMIUM FOR BOOM LENGTHS (INCLUDING JIB):

OVER 150 FT.	+2.28	OVER 185 FT.	+4.05	
OVER 210 FT.	+5.67	OVER 250 FT.	+8.59	
OVER 295 FT.	+11.86	OVER 350 FT.	+13.82.....	\$ 57.83 33.70

IRON0007-006 09/16/2025

	Rates	Fringes
IRONWORKERS:: (AREA 2).....	\$ 53.46	37.67
IRONWORKERS:: (AREA 1).....	\$ 57.87	37.67

IRON0007-010 09/16/2025

	Rates	Fringes
IRONWORKER (MIDDLESEX (ASHBY, ASHLAND, AYER, BOXBORO, HOLLISTON, HOPKINTON, HUDSON, MARLBORO, SHIRLEY, STOW, TOWNSEND); NORFOLK (MEDWAY)).....	\$ 57.57	37.67

IRON0037-005 09/16/2025

	Rates	Fringes
IRONWORKER (BARNSTABLE; BRISTOL (ACUSHNET, ATTLEBORO, BERKLEY, DARTMOUTH, DIGHTON, FAIRHAVEN, FALL RIVER, FREETOWN, MANSFIELD, NEW BEDFORD, NORTH ATTLEBORO, NORTON, RAYNHAM, REHOBOTH, SEEKONK, SOMERSET, SWANSEA, TAUNTON, WESTPORT); DUKES; NANTUCKET; NORFOLK (BILLINGHAM, FRANKLIN, PLAINVILLE, WRENTHAM)).....	\$ 43.03	33.53

LAB00022-001 12/02/2024

	Rates	Fringes
LABORERS:, HEAVY CONSTRUCTION: GROUP 6 ASBESTOS ABATEMENT; TOXIC AND HAZARDOUS WASTE LABORERS.....	\$ 40.95	29.70
LABORERS:, HEAVY CONSTRUCTION: GROUP 5 FLAGGER.....	\$ 39.70	29.70
LABORERS:, HEAVY CONSTRUCTION: GROUP 4 BLASTER; POWDERMAN.....	\$ 39.95	29.70
LABORERS:, HEAVY CONSTRUCTION: GROUP 3 AIR TRACK OPERATOR; BLOCK PAVER; RAMMER; CURB SETTER, HYDRAULIC AND SIMILAR SELF POWERED DRILLS.....	\$ 39.70	29.70
LABORERS:, HEAVY CONSTRUCTION: GROUP 2 ASPHALT RAKER; FENCE AND GUARD RAIL ERECTOR; LASER BEAM OPERATOR; MASON TENDER; PIPELAYER; PNEUMATIC DRILL OPERATOR; PNEUMATIC TOOL OPERATOR; WAGON DRILL OPERATOR, JACK HAMMER OPERATOR, PAVEMENT BREAKER, CARBIDE CORE DRILLING MACHINE, CHAIN SAW OPERATOR, BARCO TYPE JUMPING TAMPERS, CONCRETE PUMP, MOTORIZED MORTAR MIXER, RIDE-ON-MOTORIZED BUGGY.....	\$ 39.20	29.70
LABORERS:, HEAVY CONSTRUCTION: GROUP 1 LABORERS; CARPENTER TENDERS; CEMENT FINISHER TENDERS, PLASTERER TENDERS.....	\$ 38.95	29.70

LAB00022-004 12/01/2024

	Rates	Fringes
PLASTERER TENDER.....	\$ 38.95	29.70

LAB00022-005 12/01/2024

	Rates	Fringes
PLASTERER TENDER (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER ISLAND, NUT ISLAND); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP AND WOBURN ONLY); NORFOLK		

COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
PLASTERER TENDER (BARNSTABLE, BRISTOL, DUKES, ESSEX, NANTUCKET, MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE DEDHAM AND MILTON) COUNTIES).....\$ 38.95	29.70

LAB00022-009 12/01/2024

Rates

Fringes

LABORERS: GROUP 7 - FLAGGERS (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 27.01	29.70
LABORERS: GROUP 6- ASBESTOS REMOVAL LABORERS/HAZ-MAT LABORERS (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
LABORERS: GROUP 5- PRE-CAST FLOOR AND ROOF PLANK ERECTOR (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
LABORERS: GROUP 4- BLASTER; POWDERMAN (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
LABORERS: GROUP 3- AIR TRACK, BLOCK PAVER; RAMMER; CURB SETTER, HYDRAULIC AND SIMILAR SELF-POWERED DRILLS (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
LABORERS: GROUP 2 - JACKHAMMER OPERATOR; PAVEMENT BREAKER; ASPHALT RAKER CARBIDE CORE DRILLING MACHINE; CHAIN SAW OPERATOR; PIPELAYER; BARCO TYPE JUMPING TAMPERS; LASER BEAM; CONCRETE PUMP; MASON TENDER; MOTORIZED MORTAR MIXER; RIDE-ON MOTORIZED BUGGY; FENCE AND BEAM RAIL ERECTOR2 (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP, DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10	29.70
LABORERS: GROUP 1- LABORERS; CARPENTER TENDERS (SUFFOLK COUNTY (BOSTON, CHELSEA, REVERE, WINTHROP,	

DEER & NUT ISLANDS); MIDDLESEX COUNTY (ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKEFIELD, WINCHESTER, WINTHROP, AND WOBURN ONLY); NORFOLK COUNTY (BROOKLINE, DEDHAM, AND MILTON ONLY)).....\$ 46.10 29.70

LAB00022-010 12/01/2024

Rates

Fringes

LABORERS: GROUP 6- ASBESTOS REMOVAL
LABORERS/HAZ-MAT LABORERS (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 46.10 29.70

LABORERS: GROUP 5- PRE-CAST FLOOR AND ROOF PLANK ERECTOR (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 38.95 29.70

LABORERS: GROUP 4- BLASTER; POWDERMAN (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 38.95 29.70

LABORERS: GROUP 3- AIR TRACK, BLOCK PAVER; HAMMER; CURB SETTER, HYDRAULIC AND SIMILAR SELF-POWERED DRILLS (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 38.95 29.70

LABORERS: GROUP 2- JACKHAMMER OPERATOR; PAVEMENT BREAKER; ASPHALT RAKER CARBIDE CORE DRILLING MACHINE; CHAIN SAW OPERATOR; PIPELAYER; BARCO TYPE JUMPING TAMPERS; LASER BEAM; CONCRETE PUMP; MASON TENDER; MOTORIZED MORTAR MIXER; RIDE-ON MOTORIZED BUGGY; FENCE AND BEAM RAIL ERECTOR (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 38.95 29.70

LABORERS: GROUP 1- LABORERS; CARPENTER TENDERS (COUNTIES OF BARNSTABLE; BRISTOL; DUKES; ESSEX; NANTUCKET; MIDDLESEX (WITH THE EXCEPTION OF ARLINGTON, BELMONT, BURLINGTON, CAMBRIDGE, EVERETT, MALDEN, MEDFORD, MELROSE, READING, SOMERVILLE, STONEHAM, WAKFIELD, WINCHESTER, WINTHROP AND WOBURN); NORFOLK (WITH THE EXCEPTION OF BROOKLINE, DEDHAM AND MILTON)).....\$ 38.95 29.70

LAB01421-004 12/02/2024

Rates

Fringes

LABORERS:, WRECKING: GROUP 6 ASBESTOS, LEAD PAINT,
TOXIC AND HAZARDOUS WASTE. (BARNSTABLE, BRISTOL,
DUKES, ESSEX, MIDDLESEX, NANTUCKET NORFOLK AND
SUFFOLK COUNTIES).....\$ 46.25 29.70

LABORERS:, WRECKING: GROUP 5 YARDMAN, BURNERS,
SAWYERS. (BARNSTABLE, BRISTOL, DUKES, ESSEX,
MIDDLESEX, NANTUCKET NORFOLK AND SUFFOLK COUNTIES)..\$ 45.35 29.70

LABORERS:, WRECKING: GROUP 4 YARDMAN (SALVAGE YARD
ONLY). (BARNSTABLE, BRISTOL, DUKES, ESSEX,
MIDDLESEX, NANTUCKET NORFOLK AND SUFFOLK COUNTIES)..\$ 42.25 29.70

LABORERS:, WRECKING: GROUP 3 SMALL BACKHOES,
LOADERS ON TRACKS, BOBCAT TYPE LOADERS, HYDRAULIC
""BROCK"" TYPE HAMMER OPERATORS, CONCRETE CUTTING
SAWS. (BARNSTABLE, BRISTOL, DUKES, ESSEX,
MIDDLESEX, NANTUCKET NORFOLK AND SUFFOLK COUNTIES)..\$ 47.25 29.70

LABORERS:, WRECKING: GROUP 2 BURNERS, JACKHAMMERS.
(BARNSTABLE, BRISTOL, DUKES, ESSEX, MIDDLESEX,
NANTUCKET NORFOLK AND SUFFOLK COUNTIES).....\$ 47.00 29.70

LABORERS:, WRECKING: GROUP 1 ADZEMAN, WRECKING
LABORER. (BARNSTABLE, BRISTOL, DUKES, ESSEX,
MIDDLESEX, NANTUCKET NORFOLK AND SUFFOLK COUNTIES)..\$ 46.25 29.70

PAIN0011-007 06/01/2025

Rates

Fringes

GLAZIER (BARNSTABLE, BRISTOL, DUKES, AND NANTUCKET
COUNTIES) FOOTNOTE: A. PAID HOLIDAY: LABOR
DAY (PROVIDED EMPLOYEE HAS WORKED ANY PART OF THE
WEEK PRIOR TO LABOR DAY AND ANY PART OF THE WEEK
AFTER LABOR DAY).....\$ 43.13 21.00

PAIN0035-004 07/01/2024

Rates

Fringes

PAINTER SPRAY, SANDBLAST (REPAINT:.....\$ 45.72 36.00

PAINTER SPRAY, SANDBLAST (NEW CONSTRUCTION:.....\$ 47.66 36.00

PAINTER BRUSH, TAPER (REPAINT:.....\$ 44.32 36.00

PAINTER BRUSH, TAPER (NEW CONSTRUCTION:.....\$ 46.26 36.00

PAIN0035-013 07/01/2024

Rates

Fringes

PAINTER SPRAY, SANDBLAST (REPAINT:.....\$ 45.72 36.00

PAINTER SPRAY, SANDBLAST (NEW CONSTRUCTION:.....\$ 47.66 36.00

PAINTER BRUSH, TAPER (REPAINT:.....\$ 44.32 36.00

PAINTER BRUSH, TAPER (NEW CONSTRUCTION:.....\$ 46.26 36.00

PAIN0035-020 07/01/2024

Rates

Fringes

GLAZIER (ESSEX; MIDDLESEX; NORFOLK; SUFFOLK).....\$ 46.26 36.00

PLAS0534-001 07/01/2024

Rates

Fringes

CEMENT MASON/CONCRETE FINISHER (ESSEX; MIDDLESEX;
NORFOLK AND SUFFOLK COUNTY).....\$ 49.19 40.86

PLAS0534-004 07/01/2024

Rates

Fringes

PLASTERER (MIDDLESEX; NORFOLK AND SUFFOLK COUNTIES).\$ 49.19 40.86

PLUM0004-001 09/01/2025

Rates Fringes

PLUMBERS AND PIPEFITTERS (MIDDLESEX (ASHBY,
AYER-WEST OF GREENVILLE BRANCH OF BOSTON AND MAINE
RAILROAD, FT. DEVENS, GROTON, SHIRLEY, TOWNSEND))...\$ 55.00 31.57

PLUM0012-005 03/02/2025

Rates Fringes

PLUMBER (ESSEX (AMES, ANDOVER, BEVERLY, BOXFORD,
BYFIELD, DANVERS, ESSEX, GEORGETOWN, GLOUCESTER,
GROVELAND, HAMILTON, HAVERHILL, IPSWICH, LAWRENCE,
MANCHESTER, MARBLEHEAD, MERRIMAC, METHUEN,
MIDDLETON, NEWBURY, NEWBURYPORT, NORTH ANDOVER,
PEABODY, ROCKPORT, ROWLEY, SALEM, SALISBURY,
TOPSFIELD, WENHAM, WEST NEWBURY)).....\$ 69.84 36.43

PLUM0012-007 03/02/2025

Rates Fringes

PLUMBER (ESSEX (LYNN, LYNNFIELD, NAHANT, SAUGUS,
AND SWAMPSCOTT); MIDDLESEX (ACTON, ARLINGTON,
ASHFORD, AYER-EXCEPT WEST OF GREENVILLE BRANCH OF
BOSTON & MAINE RAIL ROAD, BEDFORD, BELMONT,
BILLERICA, BOXBORO, BURLINGTON, CAMBRIDGE,
CARLISE, CHELMSFORD, CONCORD, DRACUT, DUNSTABLE,
EVERETT, FRAMINGHAM, HUDSON, HOLLIISTON, HOPKINTON,
LEXINGTON, LINCOLN, LITTLETON, LOWELL, MALDEN,
MARLBORO, MAYNARD, MEDFORD, MELROSE, NATICK,
NEWTON, NORTH READING, PEPPERELL, READING,
SHERBORN, SOMERVILLE, STON.....\$ 69.84 36.43

PLUM0051-004 08/26/2024

Rates Fringes

PLUMBERS AND PIPEFITTERS (BARNSTABLE; BRISTOL;
DUKES; NANTUCKET; AND NORFOLK (AVON, HOLBROOK,
RANDOLPH, STOUGHTON) COUNTIES).....\$ 52.49 33.60

PLUM0537-005 03/01/2025

Rates Fringes

PIPEFITTER (ESSEX (AMES, ANDOVER, BEVERLY, BOXFORD,
BYFIELD, DANVERS, ESSEX, GEORGETOWN, GLOUCESTER,
GROVELAND, HAMILTON, HAVERHILL, IPSWICH, LAWRENCE,
LYNN, LYNNFIELD, MANCHESTER, MARBLEHEAD, MERRIMAC,
METHUEN, MIDDLETON, NAHANT, NEWBURY, NEWBURYPORT,
NORTH ANDOVER, PEABODY, ROCKPORT, ROWLEY, SALEM,
SALISBURY, SAUGUS, SWAMPSCOTT, TOPSFIELD, WENHAM,
WEST NEWBURY); MIDDLESEX (ACTON, ARLINGTON,
ASHFORD, AYER-EXCEPT WEST OF GREENVILLE BRANCH OF
BOSTON & MAINE RAIL ROAD, BEDFORD, BELMONT,
BILLER.....\$ 66.58 39.22

ROOF0033-001 08/01/2025

Rates Fringes

ROOFERS: (ALL TEAR-OFF AND/OR REMOVAL OF ANY TYPES
OF ROOFING AND ALL SPUDGING, SWEEPING, VACUUMING
AND/OR CLEANUP OF ANY AND ALL AREAS OF ANY TYPE
WHERE A ROOF IS TO BE RELAID).....\$ 53.53 35.69

SFMA0550-001 10/01/2025

Rates

Fringes

SPRINKLER FITTER (BRISTOL (PORTION WITHIN 35 MILE
RADIUS FROM BOSTON CITY HALL; MIDDLESEX (EXCEPT
ASHBY, TOWNSEND, AND PORTIONS OF PEPPERELL AND
SHIRLEY BEYOND 35 MILE RADIUS FROM BOSTON CITY
HALL); NORFOLK; PLYMOUTH (PORTION WITHIN 35 MILE
RADIUS OF BOSTON CITY HALL); SUFFOLK) A. PAID
HOLIDAYS: MEMORIAL DAY, JULY 4TH, LABOR DAY,
THANKSGIVING DAY AND CHRISTMAS DAY, PROVIDED THE
EMPLOYEE HAS BEEN IN THE EMPLOYMENT OF A CONTRACTOR
20 WORKING DAYS PRIOR TO ANY SUCH PAID HOLIDAY.....\$ 72.05

40.76

SFMA0550-002 10/01/2025

Rates

Fringes

SPRINKLER FITTER (BRISTOL (SEEKONK, SWANSEA, AND
SOMERSET)) A. PAID HOLIDAYS: MEMORIAL DAY, JULY
4TH, LABOR DAY, THANKSGIVING DAY AND CHRISTMAS DAY,
PROVIDED THE EMPLOYEE HAS BEEN IN THE EMPLOYMENT OF
A CONTRACTOR 20 WORKING DAYS PRIOR TO ANY SUCH PAID
HOLIDAY.....\$ 64.85

40.76

SFMA0669-001 04/01/2025

Rates

Fringes

SPRINKLER FITTER (BARNSTABLE; BRISTOL (BEYOND 35
MILE RADIUS OF BOSTON CITY HALL); DUKES; MIDDLESEX
(ASHBY, TOWNSEND, PORTIONS OF PEPPERELL AND SHIRLEY
BEYOND 35 MILE RADIUS OF BOSTON CITY HALL);
NANTUCKET; PLYMOUTH (BEYOND 35 MILE RADIUS OF
BOSTON CITY HALL)).....\$ 53.25

29.75

SHEE0017-003 04/01/2025

Rates

Fringes

SHEET METAL WORKER (ESSEX; MIDDLESEX; NORFOLK;
PLYMOUTH (EXCEPT EXCEPT MARION, MATTAPOISETT,
ROCHESTER, WAREHAM); SUFFOLK).....\$ 60.00

48.78

SHEE0017-007 10/01/2025

Rates

Fringes

SHEET METAL WORKER (BARNSTABLE; BRISTOL (ACUSHNET,
ASSONET, DARTMOUTH, DIGHTON, FAIRHAVEN, FALL RIVER,
FREETOWN, NEW BEDFORD, REHOBOTH, SEEKONK,
SOMERSET, SWANSEA, WESTPORT); DUKES; AND NANTUCKET).\$ 43.60

38.49

TEAM0379-001 06/01/2025

Rates

Fringes

TRUCK DRIVERS: GROUP 7 TRAILERS FOR EARTH MOVING
EQUIPMENT (DOUBLE HOOKUP) POWER TRUCKS \$.25
DIFFERENTIAL BY AXLE TUNNEL WORK (UNDERGROUND
ONLY) \$.40 DIFFERENTIAL BY AXLE HAZARDOUS
MATERIALS (IN HOT ZONE ONLY) \$2.00 PREMIUM
FOOTNOTES: A. PAID HOLIDAYS: NEW YEAR'S DAY,
WASHINGTON'S BIRTHDAY, MEMORIAL DAY, INDEPENDENCE
DAY, LABOR DAY, PATRIOT'S DAY, COLUMBUS DAY,
VETERAN'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY
B. PAID VACATION: EMPLOYEES WITH 4 MONTHS TO 1
YEAR OF SERVICE RECEIVE 1/2 DAY'S PAY PER MONTH; 1
WEEK VACATION FOR 1 - 5 YEARS OF SERVICE; 2 WEEKS
VACATION FOR 5 - 10 YEARS OF SERVICE; AND 3 WEEKS

VACATION FOR MORE THAN 10 YEARS OF SERVICE.....\$ 41.82 37.35
 TRUCK DRIVERS: GROUP 6 SPECIALIZED EARTH MOVING
 EQUIPMENT OVER 35 TONS POWER TRUCKS \$.25
 DIFFERENTIAL BY AXLE TUNNEL WORK (UNDERGROUND
 ONLY) \$.40 DIFFERENTIAL BY AXLE HAZARDOUS
 MATERIALS (IN HOT ZONE ONLY) \$2.00 PREMIUM
 FOOTNOTES: A. PAID HOLIDAYS: NEW YEAR'S DAY,
 WASHINGTON'S BIRTHDAY, MEMORIAL DAY, INDEPENDENCE
 DAY, LABOR DAY, PATRIOT'S DAY, COLUMBUS DAY,
 VETERAN'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY
 B. PAID VACATION: EMPLOYEES WITH 4 MONTHS TO 1
 YEAR OF SERVICE RECEIVE 1/2 DAY'S PAY PER MONTH; 1
 WEEK VACATION FOR 1 - 5 YEARS OF SERVICE; 2 WEEKS
 VACATION FOR 5 - 10 YEARS OF SERVICE; AND 3 WEEKS
 VACATION FOR MORE THAN 10 YEARS OF SERVICE.....\$ 41.53 37.35
 TRUCK DRIVERS: GROUP 5 SPECIALIZED EARTH MOVING
 EQUIPMENT UNDER 35 TONS OTHER THAN CONVENTIONAL
 TYPE TRUCKS; LOW BED; VACHUAL; MECHANICS, PAVING
 RESTORATION EQUIPMENT POWER TRUCKS \$.25
 DIFFERENTIAL BY AXLE TUNNEL WORK (UNDERGROUND
 ONLY) \$.40 DIFFERENTIAL BY AXLE HAZARDOUS
 MATERIALS (IN HOT ZONE ONLY) \$2.00 PREMIUM
 FOOTNOTES: A. PAID HOLIDAYS: NEW YEAR'S DAY,
 WASHINGTON'S BIRTHDAY, MEMORIAL DAY, INDEPENDENCE
 DAY, LABOR DAY, PATRIOT'S DAY, COLUMBUS DAY,
 VETERAN'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY
 B. PAID VACATION: EMPLOYEES WITH 4 MONTHS TO 1
 YEAR OF SERVICE RECEIVE 1/2 DAY'S PAY PER MONTH; 1
 WEEK VACATION FOR 1 - 5 YEARS OF SERVICE; 2 WEEKS
 VACATION FOR 5 - 10 YEARS OF SERVICE; AND 3 WEEKS
 VACATION FOR MORE THAN 10 YEARS OF SERVICE.....\$ 41.24 37.35
 TRUCK DRIVERS: GROUP 4 FOUR AND FIVE AXLE EQUIPMENT
 POWER TRUCKS \$.25 DIFFERENTIAL BY AXLE TUNNEL
 WORK (UNDERGROUND ONLY) \$.40 DIFFERENTIAL BY AXLE
 HAZARDOUS MATERIALS (IN HOT ZONE ONLY) \$2.00
 PREMIUM FOOTNOTES: A. PAID HOLIDAYS: NEW
 YEAR'S DAY, WASHINGTON'S BIRTHDAY, MEMORIAL DAY,
 INDEPENDENCE DAY, LABOR DAY, PATRIOT'S DAY,
 COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY AND
 CHRISTMAS DAY B. PAID VACATION: EMPLOYEES
 WITH 4 MONTHS TO 1 YEAR OF SERVICE RECEIVE 1/2
 DAY'S PAY PER MONTH; 1 WEEK VACATION FOR 1 - 5
 YEARS OF SERVICE; 2 WEEKS VACATION FOR 5 - 10 YEARS
 OF SERVICE; AND 3 WEEKS VACATION FOR MORE THAN 10
 YEARS OF SERVICE.....\$ 41.14 37.35
 TRUCK DRIVERS: GROUP 3 THREE AXLE EQUIPMENT AND
 TIREMAN POWER TRUCKS \$.25 DIFFERENTIAL BY AXLE
 TUNNEL WORK (UNDERGROUND ONLY) \$.40 DIFFERENTIAL BY
 AXLE HAZARDOUS MATERIALS (IN HOT ZONE ONLY) \$2.00
 PREMIUM FOOTNOTES: A. PAID HOLIDAYS: NEW
 YEAR'S DAY, WASHINGTON'S BIRTHDAY, MEMORIAL DAY,
 INDEPENDENCE DAY, LABOR DAY, PATRIOT'S DAY,
 COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY AND
 CHRISTMAS DAY B. PAID VACATION: EMPLOYEES
 WITH 4 MONTHS TO 1 YEAR OF SERVICE RECEIVE 1/2
 DAY'S PAY PER MONTH; 1 WEEK VACATION FOR 1 - 5
 YEARS OF SERVICE; 2 WEEKS VACATION FOR 5 - 10 YEARS
 OF SERVICE; AND 3 WEEKS VACATION FOR MORE THAN 10
 YEARS OF SERVICE.....\$ 41.02 37.35
 TRUCK DRIVERS: GROUP 2 TWO AXLE EQUIPMENT; &
 FORKLIFT OPERATOR POWER TRUCKS \$.25 DIFFERENTIAL
 BY AXLE TUNNEL WORK (UNDERGROUND ONLY) \$.40
 DIFFERENTIAL BY AXLE HAZARDOUS MATERIALS (IN HOT
 ZONE ONLY) \$2.00 PREMIUM FOOTNOTES: A.
 PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S

BIRTHDAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY B. PAID VACATION: EMPLOYEES WITH 4 MONTHS TO 1 YEAR OF SERVICE RECEIVE 1/2 DAY'S PAY PER MONTH; 1 WEEK VACATION FOR 1 - 5 YEARS OF SERVICE; 2 WEEKS VACATION FOR 5 - 10 YEARS OF SERVICE; AND 3 WEEKS VACATION FOR MORE THAN 10 YEARS OF SERVICE.....\$ 40.95 37.35

TRUCK DRIVERS: GROUP 1 STATION WAGONS; PANEL TRUCKS; AND PICKUP TRUCKS POWER TRUCKS \$.25 DIFFERENTIAL BY AXLE TUNNEL WORK (UNDERGROUND ONLY) \$.40 DIFFERENTIAL BY AXLE HAZARDOUS MATERIALS (IN HOT ZONE ONLY) \$2.00 PREMIUM

FOOTNOTES: A. PAID HOLIDAYS: NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, PATRIOT'S DAY, COLUMBUS DAY, VETERAN'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY

 B. PAID VACATION: EMPLOYEES WITH 4 MONTHS TO 1 YEAR OF SERVICE RECEIVE 1/2 DAY'S PAY PER MONTH; 1 WEEK VACATION FOR 1 - 5 YEARS OF SERVICE; 2 WEEKS VACATION FOR 5 - 10 YEARS OF SERVICE; AND 3 WEEKS VACATION FOR MORE THAN 10 YEARS OF SERVICE.....\$ 40.78 37.35

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than **SU**, **UAVG**, **SA**, or **SC** denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The **SU** identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

SU wage rates typically remain in effect until a new survey

is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The **SA** identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the **SA** identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:
Administrative Review Board

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"



Form of Contract

This Agreement, made and entered into this ____ day of October 2026, by and between the LOWELL REGIONAL TRANSIT AUTHORITY, a body politic and corporate of the Commonwealth of Massachusetts established pursuant to Chapter 161B of the General Laws (hereinafter referred to as the LRTA) and **CONTRACTOR**, (hereinafter referred to as **CONTRACTOR**) with a principal place of business at **CONTRACTOR ADDRESS**, under the following terms and conditions:

WITNESSETH:

Whereas, the LRTA invited the submission of Bids for the Standby Generator Project, hereinafter referred to as "Project;" and

Whereas, **CONTRACTOR** submitted a Bid to perform the work required to complete the Project; and

Whereas, the LRTA determined that **CONTRACTOR** was the lowest responsive and responsible bidder, **CONTRACTOR** has been awarded the Contract for this Project.

Now, therefore the LRTA and **CONTRACTOR**, agree as follows:

1. Contract Documents:

The Contract is inclusive of the Notice of Invitation for Bids (hereinafter referred to as IFB), the IFB documents, Technical Specifications, Drawings, any Addenda issued, the Bid submitted from **CONTRACTOR**, and any subsequent forms or Agreements and representations between the LRTA and **CONTRACTOR**, all of which are hereby deemed incorporated as part of this Contract.

2. Scope of Work

CONTRACTOR shall perform all of the work as required by the Contract Documents for the LRTA's Standby Generator Project at the Gallagher Intermodal Transportation Center (GITC) and Maguire Transportation Center, as set forth in the IFB Contract Specifications, Drawings, and **CONTRACTOR**'s Bid Proposal. Project communications will be discussed by specified individuals on each team. Any and all changes to the documents, schedules, or work, will need to be discussed and agreed upon by both parties.

3. Term of Contract

This Agreement shall be in effect from the date of signing, unless terminated earlier pursuant to the terms hereof. The work required to complete this Project shall begin immediately upon the signature and acceptance of the Contract by both parties. The

Contract will last for the duration of the Project. If any of part of this Agreement is to change, these alterations will need to be discussed, documented, and approved **with** the signatures of authorized representatives from both parties.

4. Compensation:

A. The LRTA shall pay **CONTRACTOR** for the performance of the work, subject to any agreed upon additions or deductions by Change Order, in current funds, the Total Contract amount of \$_____ (_____ Dollars).

B. The acceptance by **CONTRACTOR** of final payment for items and/or services provided shall be deemed a release of the LRTA from any and all claims and liabilities under this Agreement.

C. Neither the LRTA's review, approval, acceptance of, nor payment for any of the items and/or services provided shall be construed to operate as a waiver of any of the rights of the LRTA under the Agreement or any cause of action arising out of the performance of the Agreement or, if a portion of the Contract has been completed and paid in part, the remainder of the Agreement.

D. Any increase in the price or services required to complete the work specified in the scope of this Project must be made under mutual agreement by both the LRTA and **CONTRACTOR**. Any such changes must be made in writing and signed by both parties. If there are any concerns regarding the addition or status of a potential change to the Agreement, **CONTRACTOR** should contact Procurement Director, Meaghan O'Brien, at 978-459-0164 ext. 110 or m.obrien@lrta.com.

5. Payment of Compensation

CONTRACTOR will submit an invoice or requisition for payment for the work that has been fully completed or materials that are completed and dedicated to this Project. When materials are on requisition for payment or invoice, **CONTRACTOR** will work with the Procurement Director to determine the documentation required to ensure the materials are in hand and ready for use in this Project. If there are requests for payment that the LRTA is unable to approve due to funding source regulations, the LRTA and **CONTRACTOR** will meet to discuss the regulation that is not yet met and determine what steps are needed to be able to release payment. The LRTA agrees to pay **CONTRACTOR** for the performance of the scheduled Project work within forty-five (45) days of completion of the work and submission of an approved Requisition for Payment. All requisitions must be submitted to the LRTA no later than the tenth day of each month in order to be paid within a thirty (30) day timeframe.

6. Liability of the LRTA

The LRTA's liability hereunder shall be to make all payments when they shall become due, and the LRTA shall be under no further obligation or liability. The LRTA will attempt to meet any reasonable requests made by **CONTRACTOR** in order to complete this Project. Nothing held within this Agreement shall be construed to render the LRTA, or any elected or appointed official or employee of the LRTA, or their successors in office, personally liable for any obligation under this Agreement.

7. Term

CONTRACTOR shall substantially complete the work under this Contract within the time frame to be agreed and signed upon by both parties, beginning at this Contract execution hereof, unless otherwise mutually agreed upon by the LRTA and **CONTRACTOR**. If changes to the agreed upon schedule need to be made, both parties should discuss the newly required timeline and the reasons for the change so that all parties have a full understanding of the changes.

8. Hold Harmless

CONTRACTOR agrees to be solely responsible for all bills or claims for payments for services rendered by any of its subcontractors, associates, or others and for all services and materials employed by **CONTRACTOR**.

CONTRACTOR agrees to indemnify and hold harmless the LRTA and the municipality in which the services to be performed are located and all of their officers, agents, and employees, against all suits, claims, or liability of every name and nature arising out of or in consequence of negligent acts, error, or omission of **CONTRACTOR** or its agents in the performance of the work covered by this Contract and/or failure to comply with terms and conditions of this Contract whether by itself, its associates, employees, or other sources.

9. Independent Contractor

No member, director, officer, Contractor, employee, or agent of the LRTA shall be charged personally or held contractually liable under any terms or provisions of this Contract or because of any breach thereof or because of the execution of this Contract.

10. Tax and Fee Exemption

The LRTA is a tax and fee exempt Authority under Massachusetts General Laws; Chapter 161 B: Section 13. The LRTA is exempt from Federal and State Taxes.

IN WITNESS WHEREOF, the parties hereunto set their hands and seals on the day and year dated below.



Checklist for Bidders

As a reminder – all of the following items should be provided and complied with in the Bid submitted to the LRTA:

- ☐ Read and understood the INSTRUCTION TO BIDDERS
- ☐ Read and understood the PROPOSED BID SCHEDULE
- ☐ Completed and enclosed the FORM FOR BIDS
- ☐ Acknowledges receipt of all LRTA Addenda issued
- ☐ Completion of the enclosed STATEMENT OF BIDDER'S QUALIFICATIONS
- ☐ Enclosed Bid deposit of 5% of the bid price
- ☐ Bidder has thoroughly reviewed and understands the Projects specifications, requirements, and drawings
- ☐ Understands that the Federal wage rates per the current Department of Labor determination apply to the performance of the Project work. These rates are included within the IFB Document. Weekly reports to the LRTA will be required.
- ☐ Bidder has completed and complied with **all** required certifications, forms, and regulations included in the IFB bidding documents.

Acknowledged by

Company

LOWELL REGIONAL TRANSIT AUTHORITY

GALLAGHER TERMINAL

117 THORNDIKE STREET, LOWELL, MA 01852

&

MAGUIRE TRANSPORTATION CENTER

115 THORNDIKE STREET, LOWELL, MA 01852

STANDBY GENERATOR PROJECT

SPECIFICATIONS

AECOM

1 FEDERAL STREET, 8TH FLOOR
BOSTON, MASSACHUSETTS 02110

AUGUST 2026

SECTION 01 1000

SUMMARY OF THE WORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 PROJECT IDENTIFICATION

- A. General: The Project name is “**Gallagher Terminal & Maguire Transportation Center Standby Generator Project**” as shown on the Contract Documents, Drawings and Specifications which are dated August 2026.
- B. The project site is located at:
- Gallagher Terminal
117 Thorndike Street
Lowell, MA 01852
- Maguire Transportation Center
115 Thorndike Street
Lowell, MA 01852
- C. Contract Documents: Contract documents indicate the work of the Contract and related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the Contract Documents include, but are not necessarily limited to the following:
1. Existing site conditions and restrictions on use of the site.
 2. Requirements for Owner use and occupancy during Contract Work.
- D. Summary by Reference: Work of the Contract can be summarized by references to the Contract, Specification Sections, Drawings, addenda and modifications to the contract documents issued subsequent to the initial printing of this project manual and including but not necessarily limited to printed material referenced by any of these documents.

1.03 WORK UNDER THIS CONTRACT

- A. The work to be performed under this contract consists of executing and completing all work required at the Maguire Transportation Center, LRTA property at 115 Thorndike Street, Lowell, MA.

1. General Information:

- a. This document describes the scope of work for the installation of a concrete pad and a 250 KW standby generator to provide supplemental power to the Maguire Transportation Center, LRTA property at 115 Thorndike Street, Lowell, MA, and the Gallagher Terminal, MBTA property at 117 Thorndike Street, Lowell, MA.
 - b. This project requires a building permit issued by the City of Lowell, Division of Development Services.
 - c. The project shall be constructed so as to meet all requirements of 780 CMR Massachusetts State Building Code, current edition, 527 CMR 12.00 Massachusetts Electrical Code, current edition, in addition to all other applicable codes and regulations.
 - d. Miscellaneous: All other associated work as indicated in the drawings and specifications.
- B. The scope of work, without limiting the generality thereof, includes all labor, materials, equipment, and services required to perform the work described fully in the drawings and specifications.
- C. Reference To Drawings: The work to be done under this Contract is shown on the following drawings:

ELECTRICAL

E001 NOTES, SYMBOLS & SHEET LIST
E002 NOTES
E100 ELECTRICAL GENERATOR SITE PLAN
E101 ELECTRICAL ENLARGED POWER PLAN
E600 ELECTRICAL DETAILS
E700 ELECTRICAL SINGLE LINE DIAGRAM

- D. Reference To Specifications: The work to be done under this Contract is shown on the following Technical Specifications:

Section 01 1000	SUMMARY OF WORK
Section 01 1060	REGULATORY REQUIREMENTS
Section 01 3100	PROJECT COORDINATION
Section 01 3300	SUBMITTAL PROCEDURES
Section 01 4000	QUALITY REQUIREMENTS
Section 01 4200	REFERENCES
Section 01 4535	SPECIAL INSPECTIONS
Section 01 5000	TEMPORARY FACILITIES AND CONTROLS
Section 01 6000	PRODUCT REQUIREMENTS
Section 01 6100	SAFETY
Section 01 7700	CLOSEOUT PROCEDURES
Section 03 1000	CONCRETE FORMING AND ACCESSORIES
Section 03 2000	CONCRETE REINFORCING

Section 03 3000	CAST-IN-PLACE CONCRETE
Section 26 0519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
Section 26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
Section 26 0529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
Section 26 0533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
Section 26 0544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
Section 26 0553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
Section 26 2213	LOW-VOLTAGE DISTRIBUTION TRANSFORMERS
Section 26 2416	PANELBOARDS
Section 26 2726	WIRING DEVICES
Section 26 3213.13	DIESEL-ENGINE-DRIVEN GENERATOR SETS
Section 26 3600	TRANSFER SWITCHES

- E. The Federal Davis Bacon Wage Rates, as outlined and included in the exhibits, will be used in the construction of this project. In the event of a difference in rates, the higher rate will prevail.

1.04 OWNER OCCUPANCY

- A. Beneficial Use and Occupancy: The Owner will occupy and use buildings, systems, and ground during the entire construction period.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from the Owner and authorities having jurisdiction.

1.05 COORDINATION

- A. The General Contractor shall be responsible for the proper fitting of all the work and for the coordination of the operations of all trades, subcontractors or material and men engaged upon the work. The General Contractor shall do, or cause his agents to do, all cutting, fitting, adjusting, and repair necessary in order to make the several parts of the work come together properly.
1. Examine Contract Documents in advance of start of construction and identify in writing questions, irregularities, or interference to the Engineer in writing. Failure to identify and address such issues in advance becomes the sole responsibility of the Contractor. A conflict that would cause the reduction of the normal ceiling height of any occupied space is considered to be an interference.
- B. Execute the work in an orderly and careful manner with due regard to the occupants of the facility, the public, the employees, and the normal function of the facility.

- C. The work sequence shall follow planning and schedule established by the Contractor as approved by the Owner and Engineer. The work upon the site of the project shall commence promptly and be executed with full simultaneous progress. Work operations requiring the interruption of utilities, service, and access shall be scheduled so as to involve minimum disruption and inconvenience and to be expedited so as to insure minimum duration of any periods of disruption or inconvenience.

1.06 TIME OF COMPLETION

- A. The Contractor shall commence work immediately upon receipt of the executed contract and shall complete all work specified to the complete satisfaction of the Owner within ninety (90) days of receipt of the executed contract.

1.07 OWNER RESPONSIBILITIES

- A. The Owner shall provide access to all work areas as allowed for in approved schedule. The Contractor shall notify the Owner prior to working nights, weekend, or holiday hours.
- B. The Owner shall provide personnel to inform the Contractor of the characteristics of the mechanical and electrical systems.
- C. The Owner shall have personnel on call to provide the Contractor with assistance on building-related matters.

1.08 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The construction requirements of federal, state, municipal, or other political subdivision specifications exceeding the requirements of the codes, standards and approving bodies referenced herein shall be met and complied with. Comply with requirements of the National Fire Protection Association (NFPA) and Lowell Fire Department as directly appropriate to work and workmanship of this Contract.
- B. Worker's Qualifications: In acceptance or rejection of complete work, no allowance will be made for lack of skill on the part of the Contractor's forces performing such work. All Contractor personnel shall be accredited to conduct response actions in accordance with requirements of the Contract.
- C. Certificates and Permits: Upon completion of work, and prior to final payment, furnish formal certification of final inspections to the Engineer from authorities having jurisdiction and secure required permits, if any, from same. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction.

- D. Source Quality Control: Products used throughout these specifications and as indicated on the Drawings are those companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make, or products of others for which they assume full responsibility when used in said outfits (which are not manufactured completely by them), and with replacement parts available.
- E. Job Conditions:
 - 1. Contractor shall be required to provide all utilities and services needed to perform the work.
 - 2. Provide products of new and recent manufacture.
 - 3. For each category of materials and equipment (Products), use material equipment of the same manufacturer and type.

1.09 EXAMINATION OF SITE AND DOCUMENTS

- A. A pre-bid conference will be held at the jobsite on the date and at the time indicated in the Invitation to Bid.
- B. Bidders shall be permitted to visit the site on a non-holiday week day acceptable to the Owner, between the hours of 9:00 a.m. and 3:00 p.m. to visually inspect the location of the work and existing conditions that may affect new work. Please contact Mr. Todd Bello at (978) 375-3791 to schedule a visit if needed.
- C. The bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which the work is to be carried out. The Owner will not be responsible for errors, omissions, and/or charges for extra work arising from the General Contractors or Subcontractors failure to familiarize themselves with the Contract Documents, that he is familiar with the conditions and requirements of both where they require, in any part of the work a given result to be produced, that the contract documents are adequate and he will produce the required results.
- D. Contact: Meaghan O'Brien, Procurement and Compliance Director
Lowell Regional Transit Authority
115 Thorndike Street
Lowell, MA 01852
Tel.: 978-459-0164
Email: m.obrien@lrta.com

1.10 CONTRACTOR QUALIFICATION

- A. The Contractor shall certify in writing that he/she has successfully performed on at least three (3) construction projects of equivalent scope, size and complexity.

1.11 SUPERVISION OF WORK

- A. The Contractor shall be held directly responsible for the correct installation of all work performed under this Contract. The Contractor must make a good repair, without expense to the Owner, of any part of the new work, or existing work to remain, which may become inoperative on account of leaving the work unprotected or unsupervised during construction of the system or which may break or give out in any manner by reason of poor workmanship, defective materials or any lack of space to allow for expansion and contraction of the work during the Contractor's warranty period, from the date of final acceptance of the work by the Owner.

1.12 FIELD MEASUREMENTS

- A. Although care has been taken to ensure their accuracy, the dimensions shown for existing items and structures are not guaranteed. It is the responsibility of the Contractor to verify these dimensions in the field before fabricating any construction component. No claims for extra payment due to incorrect dimensions will be considered by the Owner.

1.13 WORK SEQUENCE

- A. The Contractor shall commence work and shall maintain a sufficient work force at all times to ensure satisfactory completion within allotted construction time period and following the approved schedule.

1.14 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated on approved schedule. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
- B. Owner Occupancy: Allow for Owner occupancy and use by the public.
- C. Driveways and Entrances: Keep driveways and entrances serving the Gallagher Intermodal Transportation Center clear and available to the Owner, the Owner's employees, and emergency vehicles at all times as indicated in documents. Contractor staging and laydown areas shall be as indicated in the drawings including protections for the public.
- D. Schedule and perform work to afford minimum of interruption to normal and continuous operation of utility systems. The Contractor shall submit to the Owner and Engineer for approval, proposed schedule for performing work; including construction of new utilities, rerouting of existing utilities and final connection of new work to existing work. Schedule shall indicate shutdown time required for each operation.
- E. The Contractor shall notify the Owner in writing 72 hrs in advance of the proposed time for shutting down or interrupting any utilities, services, or facilities that may affect the operation of other buildings, services or facilities of the LRTA.

- F. Coordinate with Owner and Engineer any work in connection with adjacent driveways, walks, or other facilities that would prevent access thereto or interrupt, restrict, or otherwise infringe upon the Owner's use thereof.
- G. The Contractor shall be aware of the sensitivity of the neighborhood tenants and organizations to noise, dust, debris, and site maintenance and take appropriate precautions to avoid conflict.
- H. Damage to existing work, if caused by the Contractor's operations under this Contract, shall be repaired at the Contractor's expense.
- I. An existing conditions survey shall be conducted, with the Engineer, and the Owner, at which existing conditions will be documented by the Contractor. Documentation will be submitted to the Owner.
- J. Walks, paved or landscaped areas over which temporary driveways cross, laydown areas are constructed, or scaffolding is erected, shall upon completion of the work, be restored to their original condition.
- K. The Contractor can gain access to the premises during the hours specified below. In addition, the Contractor and his personnel will limit themselves only within the working premises during working hours. Contractor shall have no use of public restrooms. If work needs to be scheduled during times other than those listed below, Contractor shall inform the Owner one week prior to work.
 - 1. Deliveries: 6:30 a.m. to 4:00 p.m.
 - 2. General Access: 6:30 a.m. to 4:00 p.m.
- L. Confine operations at the site to areas permitted by:
 - 1. Laws,
 - 2. Ordinances,
 - 3. Permits,
 - 4. Contract Documents,
 - 5. Owner's Regulations.
- M. All available existing utilities adjacent to the construction site will be available for use during construction unless indicated otherwise. These utilities would include water, sewer, and electricity. Temporary connections to these utilities, all metering, transformers, removal, usage, and their associated costs will be the responsibility of the Contractor.

1.15 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements for the standard, except where more rigid requirements are specified or are required by codes. Refer to Section 01 42 00 – REFERENCES.

- B. Where reference is made in the Contractual Documents to Publications and Standards issued by Associations or Societies, the intent shall be understood to specify the current edition of such Publications or Standards (including tentative revision) in effect on the date of the contract advertisement notwithstanding any reference to a particular date.

1.16 PROJECT MEETINGS

- A. Project progress meetings shall be held on a weekly basis or as scheduled by the LRTA's Project Manager.
- B. As a prerequisite for monthly payments, ordering schedules, shop drawing schedules, and coordination meeting schedules shall be prepared and maintained by the Contractor and shall be revised and updated on a monthly basis, and a copy shall be submitted to the Project Manager, Owner and Engineer.
- C. Scheduling shall be discussed with all concerned parties, and methods shall be presented by the Contractor which shall reflect the completion not being deferred, at no additional cost to the Owner.
- D. Minutes of the project progress meetings will be prepared by the LRTA's Project Manager and will be distributed in a timely manner to all attendees.

1.17 PERMITS, INSPECTION AND TESTING REQUIRED BY GOVERNING AUTHORITIES

- A. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having any jurisdiction require any portion of the Work to be inspected, tested, or approved, the Contractor shall give the Engineer, and such Authority timely notice of its readiness so that the Engineer may observe such inspecting, testing, or approval.
- B. Prior to the start of construction, the Contractor shall complete application to the applicable Building Code enforcement authority for a Building Permit. Such Permit shall be displayed in a conspicuous location at the project site.
- C. The Contractor shall apply for Building Permits within 14 days after receipt of executed contract. Contractor must progress work such as to not cause suspension of permit. Any costs resulting from suspension of permit relation to Contractor's actions or inaction to be borne by Contractor, including upgrades mandated by code changes.
- D. Provide copies of all permits to the Owner and Engineer

1.18 DEBRIS REMOVAL

- A. Debris shall not be permitted to accumulate and the work shall at all times be kept satisfactorily clear on a daily basis to permit access to the site and areas surrounding the work zones.
- B. The Contractor shall removal all non-hazardous debris from the site of the work and shall legally dispose of it at any private or public disposal facility as the contractor may choose. The Contractor shall make all arrangements, obtain all permits and required approvals and bear all costs for such disposal. Garbage to be removed daily.

1.19 PROTECTION OF PROPERTY AND THE PUBLIC

- A. Construct all fences, barricades, and protective facilities required for the protection of the public in accordance with city and state regulations. Furnish and install all signs, light reflectors, and all such protection facilities as may be required.
- B. The Contractor shall hold the Owner and the Engineer harmless from all claims arising from the use of public streets, sidewalks, and adjoining premises for construction purposes.
- C. Keep all access roads and walks clear of debris, materials, and equipment during demolition operation. Repair streets, drives, curbs, sidewalks, poles, and the like where disturbed by the operation and leave them in good condition after completion of the work as before operation started.
- D. Protect everything on the premises from injury by water, frost, wind, fire, accident or other cause, and any interference.
- E. Pay fees for police details and fire watches required by local Authorities.

1.20 DAMAGE RESPONSIBILITY

- A. The Contractor shall repair, at no cost to the Owner, any damage to building elements, site appurtenances, landscaping, utilities, etc., caused during demolition operation and work of this Contract.

1.21 SAFETY REGULATIONS

- A. This project is subject to compliance with Public Law 91-596 "Occupational Safety and Health Act," latest edition (OSHA 29 CFR 1926), with respect to all rules and regulations pertaining to construction, including Volume 36, numbers 75 and 105, of the Federal Register, as amended, and as published by the U.S. Department of Labor.
- B. Submit the name of the Contractor's safety officer to the Owner. Submit copies of safety reports to the Owner monthly.
- C. All accident reports are to be transmitted to the Owner within 24 hrs of occurrence.

1.22 OSHA SAFETY AND HEALTH COURSE DOCUMENTATION

- A. OSHA Safety and Health Course Documentation Records: Chapter 306 of the Massachusetts Acts of 2004 requires that everyone employed at the jobsite must complete a minimum 10 hour long course in construction safety and health approved by the U.S. Occupational Safety and Health Administration (OSHA) prior to working at the jobsite. Compliance is required of contractors' and subcontractors' on-site employees at all levels, whether stationed in the trailer or working in the field. Unless the Massachusetts Attorney General's office indicates otherwise, this requirement does not apply to home-office employees visiting the site or to suppliers' employees who are making deliveries.

- B. Documentation records shall be initially compiled by the Contractor and Subcontractors as part of their certified payrolls, and the Contractor shall create and maintain a copy of the documentation on site at all times. On-site documentation shall be filed in alphabetical order and immediately available to Owner and OSHA inspectors. Fines imposed for noncompliance shall be promptly paid by the Contractor at no additional expense to the Owner. Delays in the progress of the Work caused by such noncompliance will not be acceptable as the basis for an extension of contract time or change order request.

1.23 VISITORS' LOG AND OTHER DATA

- A. The Contractor shall maintain a daily job log containing entries describing the progress and location of the work, any special conditions encountered, records of testing, amount of material removed, and other pertinent data.

1.24 ASBESTOS AND HAZARDOUS MATERIALS DISCOVERY

- A. If unanticipated asbestos-containing materials or other hazardous materials not included in Contract are discovered at any time during the course of work, the Contractor shall cease work in the affected areas only and continue work in other areas, at the same time notify Owner and the Engineer of such discovery. Do not proceed with work in such affected areas until written instructions are received. If removal is required, payment will be made in accordance with the contract unit prices bid for each respective material. In the absence of unit prices, costs shall be negotiated or otherwise established prior to commencement of removal, in accordance with provisions of the Contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 1060

REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 REQUIREMENTS

- A. General Laws
- B. Air Pollution Control
- C. Permits and Licenses
- D. Motor Vehicles
- E. Public Safety and Convenience

1.03 GENERAL LAWS

- A. The Contractor shall keep himself fully informed of all state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all orders and decrees of bodies and tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the contract for the work in relation to any law, ordinance, regulation, order or decree, the Contractor shall forthwith report the same to the Engineer in writing. He shall at all times observe and comply with and shall cause all his agents and employees to observe and comply with all existing laws, ordinances, regulations, orders and decrees.
- B. It shall be the responsibility of the Contractor to observe and practice to the fullest extent practicable controls, procedures and methods lending themselves to protection of the human and natural environment.
- C. The Contractor shall at all times observe and comply with and shall cause all his agents and employees to observe and comply with all existing laws, ordinances, regulation, orders and decrees especially in their relationship to the protection of the total environment.

1.04 APPLICABLE CODES AND REGULATIONS

- A. All work shall be performed in accordance with all applicable codes including but not limited to:
 - 1. 780 CMR Massachusetts State Building Code, 10th edition
(Effective 10/11/2024)

- a. International Building Code (IBC) – 2021 Edition
 - b. National Fire Protection Association: NFPA 100 – Standard for Emergency and Standby Power Systems – 2019 Edition
2. 527 CMR 12.00 Massachusetts Electrical Code (Effective 04/24/2026)
 - a. National Fire Protection Association: NFPA 70 – National Electrical Code (NEC) – 2026 Edition
3. United States Occupational Safety and Health Administration (OSHA)

1.05 WAGE RATE COMPLIANCE

- A. The Contractor is responsible to ensure that the rate per hour to be paid to workers employed on the work shall not be less than the approved wage rates applicable to this project. A legible copy of the approved rates shall be posted on site and shall be clearly visible for review by all workers.

1.06 AIR POLLUTION CONTROL

- A. The Contractor shall comply with the provisions of Chapter 111, as amended, of the General Laws of the Commonwealth of Massachusetts pertaining to and establishing the Air Pollution Control Districts in the Commonwealth. The burning of trees, brush and other construction debris will not be permitted on the project site. The Contractor shall provide other satisfactory, approved methods of disposal without additional compensation.

1.07 PERMITS AND LICENSES

- A. The Contractor shall procure all required permits and licenses and give all notices necessary and incidental to the due and lawful prosecution of the work. Per MGL Chapter 161B, Section 13, The LRTA is exempt from taxes, excise or assessment and is not required to pay any fee or charge for any permit or licenses issued to it by the commonwealth or by any department, board or officer of such political subdivision. Copies of all required permits and licenses shall be filed with the Owner and the Engineer prior to beginning of work.

1.08 MOTOR VEHICLES

- A. No vehicle shall be driven on any way, as defined in Section 1 of Chapter 90 of the General Laws, unless such vehicle is constructed or loaded so as to prevent any of its load from dropping, sifting, leaking or otherwise escaping therefrom, except that sand may be dropped for purposes of securing traction or water or other substances may be sprinkled on such a way in cleaning or maintaining the same (General Laws, Chapter 85, Section 30 as amended).

1.09 PUBLIC SAFETY AND CONVENIENCE

- A. The Contractor shall at all times be responsible for the protection of the work and shall take all precautions for preventing injuries to persons or damage to property on or about the project.
- B. Trenches shall not be opened in traveled ways until all materials and equipment required for the work are at the site and available for immediate use. When work is not in progress, trenches in areas subject to public travel shall be covered with steel plates capable of safely sustaining a 36.5 ton truck load with impact. The work at each trench shall be practically continuous, with the placing on conduit and piping, backfilling and patching of the surface closely following each preceding operation.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 3100

PROJECT COORDINATION

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 SUMMARY

- A. Description
 - 1. Coordinate scheduling, submittals and work of the various trades and elements of the work to ensure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.
 - 2. Coordinate sequence of the work to accommodate continuous occupancy by Owner.
- B. Meetings: In addition to progress meetings, hold coordination meetings and preinstallation conferences with personnel and subcontractors to ensure coordination of the work.
- C. Coordination of Submittals:
 - 1. Schedule and coordinate submittals.
 - 2. Coordinate work of various trades having interdependent responsibilities for installing, connecting to and placing in service such equipment.
 - 3. Coordinate requests for substitution to ensure compatibility of space, of operating elements and effect on work of other trades.

1.03 DESCRIPTION OF WORK

- A. Minimum administrative and supervisory requirements necessary for coordination of work on the project include but are not necessarily limited to the following:
 - 1. Surveys and records or reports
 - 2. Limitations for use of site
 - 3. Construction staging
 - 4. Cleaning and protection

1.04 ENGINEERING / LAYOUT OF WORK

- A. The Contractor, at his own expense, shall furnish all engineering services required for establishing grades, lines, levels, dimensions and reference points for all trades; shall be responsible for maintaining benchmarks and other survey marks, and shall replace, as directed, any benchmarks which have been distributed or destroyed.
- B. Drawings shall not be scaled to determine dimensions.
- C. Advise entities performing work of marked lines and levels provided for their use.
- D. The Contractor shall compare all grades, line, levels and dimensions as shown on the Drawings and actual site conditions and shall immediately report to the Engineer any inconsistencies and discrepancies for review and clarification prior to proceeding with the work. The Contractor will be liable for all costs associated with the removal and replacement of any work done by the Contractor knowing that inconsistencies or discrepancies exist and not reporting such issues to the Engineer.

1.05 LIMITATIONS ON USE OF SITE

- A. General: Limitations on site usage as well as specific requirements that impact site utilization are indicated by other Contract Documents. In addition to these limitations and requirements, administer allocation of available space equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.
- B. Burial of Waste Materials: Do not dispose of organic and hazardous materials on site, either by burial or by burning.

1.06 PROTECTION OF PROPERTY

- A. Existing Surfaces and Facilities
 - 1. Take positive action to protect all existing surfaces and facilities from any damage resulting from construction operations unless modifications to the surface or facilities are required as part of the contract. Protect existing building and keep it weather tight.
 - 2. Protect all paving, landscaping and utility facilities from damage caused by mobile and stationary equipment, including vehicles delivering materials to the site.
 - 3. Protect all finished surfaces through which materials are handled against any possible damage resulting from the conduct of the work by all trades.

B. Utilities

1. Protect and maintain all existing utilities and cause no interruption of service. These utilities include but are not limited to gas, electric, telephone, drainage, sanitary sewer and water.

C. Repair of Damages

1. As soon as possible after discovery of any damage by construction to surfaces of facilities which are to remain in place, repair such damage. All repairs shall result in conditions equal in strength to the previous conditions. All repaired surfaces shall be identical in color and texture to the adjacent existing materials, except that where materials cannot be matched, refinish the surrounding area to give a uniform appearance acceptable to the Owner and Engineer.

1.07 FIRE PROTECTION

- A. Take adequate precautions against fire throughout all operations. Flammable material shall be kept at an absolute minimum and shall be properly handled and stored. Except as otherwise provided herein, do not permit fires to be built.
- B. Construction practices, including cutting and welding and protection during construction, shall be in accordance with the published standards of the Factory Mutual Insurance Association, the National Fire Protection Association and the City of Lowell's Fire Department. Provide approved non-freeze portable fire extinguishers distributed about the project.
- C. Store gasoline and other flammable liquids in Underwriters Laboratories-listed safety containers in conformance to the National Board of Fire Underwriters' recommendations.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 CLEANING AND PROTECTION

- A. General: During handling and installation of work at the project site, clean and protect work in progress and adjoining work as the basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of substantial completion.
- B. Clean and perform maintenance on installed work as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures of Work: To the extent possible through reasonable control and protection methods, supervise performance of the work in such a manner and by such means as will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Such exposure includes, where applicable, but not by way of limitation, the following:

1. Excessive static or dynamic loading
2. Excessive internal or external pressures
3. Excessively high or low temperatures
4. Thermal shock
5. Excessively high or low humidity
6. Air contamination or pollution
7. Water or ice
8. Solvents
9. Chemicals
10. Light
11. Radiation
12. Puncture
13. Abrasion
14. Heavy traffic
15. Soiling
16. Bacteria
17. Insect infestation
18. Combustion
19. Electrical current
20. High speed operation, improper lubrication, unusual wear or other misuse
21. Incompatible interface
22. Destructive testing
23. Misalignment
24. Excessive weathering
25. Unprotected weathering
26. Improper shipping or handling
27. Theft
28. Vandalism

END OF SECTION

SECTION 01 3300

SUBMITTAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 SUMMARY

- A. Work Included:
1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.
 2. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for their review by the Engineer.
 3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.
 4. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Engineer before being incorporated into the work.
- B. Related Work Specified Elsewhere: Individual requirements for submittals are described in pertinent other Sections of these Specifications.
- C. Submit two (2) copies of all documents required to be submitted to the Engineer, unless noted otherwise. Engineer Contact Information:

Louis J. Free, AIA, NCARB
Project Manager, Architect of Record
AECOM
1 Federal Street, 8th Floor
Boston, Massachusetts 02110
Phone: 860-803-3619
Email: louis.free@aecom.com

Meaghan O'Brien
LRTA Project Manager
c/o Lowell Regional Transit Authority
115 Thorndike Street
Lowell, MA 01852
Phone: 1-978-459-0164
Email: m.obrien@lrta.com

1.2 SUBMITTAL SCHEDULE

- A. Within fourteen (14) calendar days after execution of the Contract and before any items are submitted for review, compile a complete and comprehensive schedule for all submittals anticipated to be made during progress of the work and submit two (2) copies to the Engineer. The schedule of submittals must be coordinated with the Contractor's construction schedule. Include a list of each type of items for which Shop Drawings, Product Data, Samples, Certificates of Compliance, guarantees, mock-ups, or other types of submittals are required. Indicate whether proposed materials, equipment, and other items are as specified or will be submitted as an "or equal". Upon review and approval by the Engineer, the Contractor will be required to adhere to the schedule except when specifically otherwise permitted. Coordinate the schedule with all necessary subcontractors and material suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere.
- B. Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit revised schedule to the Engineer for review and comment.

1.3 TIMING OF SUBMITTALS

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- B. Engineer's Review Time: In scheduling, allow at least 14 calendar days for review by the Engineer following his receipt of the submittal. The Engineer will stamp all submittals 'Received', and the date so stamped shall be the official receipt date.
- C. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the Contract Completion Date.

1.4 SHOP DRAWINGS, PRODUCTS DATA, AND SAMPLES

- A. Shop Drawings:
 - 1. Original drawings shall be prepared by General Contractor, Subcontractor, Supplier, or Distributor that illustrate some portion of the Work, showing fabrication, layout, setting, or erection of details.
 - a. Shop drawings shall be prepared by a qualified detailer.

- b. Details shall be identified by reference to sheet and detail numbers indicated on Contract Drawings.
- c. Maximum sheet size shall be 30 in. by 42 in.
- d. Submit with the required number of opaque prints specified herein.

B. Product Data:

- 1. Manufacturers' catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data. Provide manufacturer's catalogue sheet, specification for each product, and other pertinent data as required under the individual specification.
 - a. Modify product data submittals to delete information that is not applicable to the project.
 - b. Supplement standard information to provide additional information applicable to the project.
 - c. Clearly mark each copy to identify pertinent materials, products, or models.
 - d. Show dimensions and clearances required.
 - e. Show performance characteristics and capacities.
 - f. Show wiring diagrams and controls.
- 2. All such data shall be specific and identification of material or equipment submitted shall be clearly made in ink. Data of general nature will not be accepted.
- 3. Product Data shall be accompanied by transmittal notice. The Contractor's stamp of approval shall appear on the printed information itself.

C. Samples:

- 1. Physical samples shall illustrate materials, equipment or workmanship, and shall establish standards by which work is judged. After review and approval, samples may be used in construction of project if not retained for comparison.
 - a. Office samples of sufficient size and quantity shall clearly illustrate the following:
 - 1) Functional characteristics of product or material, with integrally related parts and attachment devices.
 - 2) Full range of color samples.
 - 3) After review and approval by Engineer, samples may be used in construction of project if not retained for comparison.

- b. Field Samples and Mockups:
 - 1) Erect at project site at locations acceptable to the Engineer.
 - 2) Construct each sample of mockup complete, including work of all trades required in finished work.
- 2. Unless otherwise specified in the individual Section, the Contractor shall submit two labeled specimens of each Sample.
- 3. Samples shall be of adequate size to permit proper evaluation of material. Where variations in color or in other characteristics are to be expected, samples shall show the maximum range of variation. Materials exceeding the variation of the approved samples will not be approved on the Work.
- 4. Samples that can be conveniently mailed shall be sent directly to the Engineer, accompanied by transmittal notice. On the transmittal notice the Contractor shall stamp his approval of samples submitted.
- 5. All other samples shall be delivered at the field office of the Contractor with sample identification tag attached and properly filled in. Transmittal notice of samples so delivered with the Contractor's stamp of approval shall be mailed concurrently to the Engineer to confirm their receipt.
- 6. If sample is rejected by the Engineer, a new sample shall be resubmitted in the manner specified herein above. This procedure shall be repeated until the sample is approved in writing by the Engineer.
- 7. Samples will not be returned unless return is requested at the time of submission. The right is reserved to require submission of samples, whether or not specified in the Specifications, at no additional cost to the Owner.
- D. Mockups: Erect at project site at location acceptable to Project Manager & Engineer, each mockup complete, including work of all trades required in finished work.
- E. Operations and Maintenance Data:
 - 1. Manuals shall be submitted as per the Specification Section 21 13 00- Fire Protection, Section 22 00 00-Plumbing and Section 26 05 10 Electrical.
 - 2. Manuals shall be submitted for each equipment item as follows:
 - a. One copy of sample formats and outline of contents in draft form 30 days to the earliest scheduled equipment delivery to be submitted to the Owner for approval.
 - b. One copy of complete manual in final form on equipment delivery date.
 - c. Five copies of approved manual after the equipment is installed and ready to test.

3. Manuals shall be prepared from the following materials:
 - a. Loose lead, on 60-pound, punched paper
 - b. Hole reinforced with plastic cloth
 - c. Page size, 8-1/2 inches by 11 inches
 - d. Foldout diagrams and illustrations
 - e. Reproducible by dry-copy xerography method
 - f. Oil-, moisture, and wear-resistant plastic covers
4. General Requirements for Manuals:
 - a. Manufacturer's operating manuals giving complete instructions relative to assembly, installation, operation, adjustment, lubrication, maintenance, and complete parts list shall be furnished by the Contractor for every item of machinery and equipment furnished by the Contractor.
 - b. Manuals furnished may be manufacturer's standard publications in regard to size and binding provided they comply with specified requirements relative to quantity and quality of information and data.
 - c. Manuals shall be bound in hard or flexible covers. Illustrations shall be clear, and printed matter, including dimensions, letter on drawings, shall be easily legible. If reduced drawings are incorporated into manuals, original lines and letter shall be made heavier up as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.
5. Format Manuals as follows:
 - a. Title Page: Include the name and function of the equipment, manufacturer's identification number, and the Project Specifications number and title.
 - b. Table of Contents, in numerical order listing each section and subsection title of the O&M Manual with reference to the page on which each starts and a list of included diagrams and drawings.
 - c. Index, in alphabetical order
 - d. Frontispiece: Recognition illustration of the equipment, including major assemblies and subassemblies, and giving manufacturer's model number and drawing number.
 - e. Operation instructions including step-by-step preparation for starting, operation, shutdown and draining, and emergency requirement.
 - f. Control diagrams, as-installed by the manufacturer.
 - g. Sequence of operation by the control manufacturer.
 - h. Wiring diagrams, as-installed and color coded, of electrical motor controllers, connections, and interlock connections.
 - i. Diagrammatic location, function, and tag numbers of each valve.

- j. Maintenance instructions: include step-by-step procedures for inspection, operation checks, cleaning, lubrication, adjustments, repair, overhaul, disassembly and reassembly of the equipment for proper operation of the equipment. Include list of special tools which are required for maintenance with the maintenance information.
 - k. Possible breakdowns and repairs. Troubleshooting flow charts shall be included for diagnosis of any major system or control.
 - l. Manufacturer's parts list of functional components, control diagrams, and wiring diagrams, giving manufacturer's model number and manufacturer's part number.
 - m. "Long-Lead-Time" spare parts list for spare parts not readily available on the open market or for which it is anticipated ordering and delivery time will exceed 10 days.
 - n. List of nearest local supplier of all equipment part.
 - o. Recommended preventative maintenance schedule for major system components including lubrication schedule indicating type and frequency of lubrication.
 - p. Manufacturer's warranty and guarantee data.
 - q. Spare parts data as follows:
 - 1) Complete List of parts and supplied, with current prices and source of supply.
 - 2) List of additional items recommended by manufacturer to assure efficient operation for period of 120 days.
 - r. Appendix: Include safety precautions, a glossary, and, if available at time of submittal, copies of test reports, and other relevant material not specified to be submitted.
 - s. Delete information on material or equipment not used in the work from the O&M Manual
6. Operating Diagrams
- a. Piping systems, electrical wiring diagrams, fuel oil, lubricating oil, water capacity diagrams, and other diagrams necessary for operation of machinery and equipment shall be furnished and installed where designated by the Engineer.
 - b. No single diagram shall show more than one system, or parts thereof.
 - c. Diagrams shall be reproduced by photographic process to a size not to exceed 18 inches by 24 inches and shall be complete and legible in all respects. Systems shall be subdivided into portions where are operable from location where diagrams are installed, and to provide intelligible information within specified material improvements to moisture and oil, and resistance to abrasion. Other formats which are equal in clarity, sharpness, durability, and permanence will be considered.

F. Manufacturer's Instruction

1. When required in individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing, in quantities specified for product data with two additional copies submitted to the Owner.

G. Certificates of Compliance: Submit certificates of compliance with the associated Shop Drawings, Product Data, and Samples required for the product in quantities specified for certificates of compliance, with two additional copies submitted to the Owner.

H. Field Samples: Provide field samples of finishes at the project as required by individual Specification Section. Install sample complete and finished.

I. Patterns and Colors: Submit accurate color charts and pattern charts to the Engineer for review and selection whenever a choice of color or pattern is available in a specified product, unless the exact color and pattern of a product are indicated in the Contract Documents. Color and pattern charts shall represent the manufacturer's complete standard offerings, except where Specifications limit the offerings by defining a particular series or product type which is normally limited in color and pattern availability. Color and pattern charts shall be submitted in quantities specified with two additional copies submitted to the Owner.

1.5 CONTRACTOR'S RESPONSIBILITIES:

A. Review submittals prior to submission. Verify the following:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications.

B. All shop drawings prepared by subcontractors shall be processed through the Contractor. The Contractor shall check all the shop drawings for conformity with the Contract Documents and particularly for field measurements and proper fit with adjoining work prior to submitting same to the Engineer for approval. Duplication of Contract Documents without field verification is not acceptable. Certification shall appear on each shop drawing stating that the General Contractor has made his/her check. Format and content of the Contractor's certification stamp shall be subject to approval by the Engineer and shall include, but not be limited to:

1. The term "By Others" shall not be used on shop drawings, the Contractor shall state by whom related items are to be furnished and/or installed.
2. The Engineer reserves the right to reject and return to the Contractor, without examination, any shop drawings that have not been previously checked and certified as outlined above, that carry the term "by other" or such vague reference, that are difficult to read, that have arrived by FAX, or that in any way are obviously not in conformity to Contract Requirements.

3. Shop drawings shall show materials, design, dimensions, connections, and other details necessary to ensure that they accurately interpret the Contract Documents and shall also show adjoining work in such detail as required to provide proper connection with same.
 4. The Engineer will check and approve shop drawings only for conformance with the design concept and for compliance with information given in the Contract Documents. Approval of shop drawings by the Engineer will not release the Contractor from his responsibility for furnishing same of proper dimensions, size quantity and quality to effectively perform the work and carry out the requirements and intent of Contract Documents.
 5. Such approval will not relieve the Contractor from responsibility for errors of any sort in the shop drawings, nor for the proper coordination of any submittal with all other work. If the shop drawings deviate, or are intended to deviate, from the Contract Documents, the Contractor shall so advise the Engineer in writing at the time the shop drawings are submitted, stating the difference in value between the Contract requirements and that denoted by said shop drawings.
 6. The Contractor shall assume full liability for delay attributed to insufficient time for delivery and/or installation of material or performance of the work when approval of pertinent shop drawing is withheld due to the failure of the Contractor to submit, revise, or resubmit shop drawings in adequate time to allow the Engineer a reasonable time, not to exceed fourteen days, for normal checking and processing of each submission or resubmission.
- C. Coordinate each submittal with requirements of Contract Documents.
- D. The Contractor's responsibility for errors and omissions in submittals is not relieved by the Engineer's review and approval of submittals, unless Engineer gives tentative written acceptance of specific deviations subject to written concurrence by the Owner.
- E. Notify the Engineer in writing at the time of submission, of deviations in submittals from requirements of Contract Documents or previous submissions.
- F. Work that requires submittals shall not commence unless submitted with Engineer's stamp and initials or signature indicating review and approval.
1. No work shall be started in the shop or on the job, or materials delivered to the site, until pertinent shop drawings have been approved by the Engineer.
- G. After aforesaid review and approval, distribute copies.
- H. Maintain one copy of each approved submittal at the project site.

1.6 SUBSTITUTIONS

A. Approval Required:

1. The Contract is based on the standards of quality established in the Contract Documents.
2. Products proposed for use shall require approval by the Engineer before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Engineer.
4. Unapproved materials incorporated in the work shall be removed and replaced with approved materials at the Contractor's expense.

B. "Or Approved Equal":

1. When submitting proposed substitutions as "Or Equal" refer to Article 9 of the General Conditions and Specification Section 016000 – Product Requirements for required procedures. Include all pertinent data establishing quality, appearance, workmanship, design, capacity, surface finish, and all metal gauges within the construction of the product. Also include related information of proprietary product of manufacturer cited herein as a basis for comparison.

1.7 SUBMISSION REQUIREMENTS:

- A. General: All submittals shall be made to the Engineer's Office except for samples as noted. The quantity and make-up of submittals shall be as established by the Engineer. The Engineer will log and distribute submittals for review by his consultant engineers. The Contractor shall distribute all Civil, Structural, and MEP shop drawings directly to the Engineer.
- B. Make submittals promptly in accordance with approved schedules and in such sequence as to cause no delay in the work.
- C. Submit number of samples specified in each Section of the Specifications.
- D. Submittals shall include the following:
 1. Date and revision dates.
 2. Project title and number.
 3. The names of:
 - a. Designer;
 - b. General Contractor;
 - c. Subcontractor;
 - d. Supplier;
 - e. Manufacturer;
 - f. Separate detailer when pertinent.

4. Identification of product or material.
5. Relation to adjacent structure or materials.
6. Field dimensions clearly identified as such.
7. Specification Section number and specific paragraph under which item is specified.
8. Submission number.
9. Applicable standards, such as ASTM number.
10. A blank space, 5 in. by 4 in., for the Designer's stamp.
11. Contractor's remarks. Identify exceptions or deviations from Contract Documents and reasons for them.
 - a. If shop drawings submitted by the General Contractor indicate a departure from the Contract and the Engineer deems it to be minor adjustment in the interest of Owner (subject to concurrence by the Contractor stating it does not involve a change in Contract Price or extension of time), the Engineer may approve the submission, but the approval shall be subject to Owner review and acceptance of the Engineer's recommendation.
 - b. The approval of Owner shall be inferred to contain in substance the following: The change is so ordered with the understanding that it does not involve any change in the Contract Price or Time and that it is subject generally to all contract stipulations and covenants and is without prejudice to any and all rights of Owner under the Contract.
12. General Contractor's stamp, initialed or signed certifying review and approval of submittal.
13. Any other items as called for by the Engineer, the Owner or required by the manufacturers.
14. The Engineer reserves the right to ask for shop drawings for any or all items on the project, whether or not requested in individual specification sections, at no additional cost to the Owner.

1.8 RESUBMISSION REQUIREMENTS:

- A. Resubmission: Resubmission procedure shall follow the same procedures as the initial submittal with the following exceptions:
- B. Shop Drawings:
 1. Transmittal shall contain the same information as the first transmittal except that the submission number shall change sequentially. The drawing number/description shall be identical as the first transmittal but the date shall be the revised date for that submission.

2. No new material should be included on the same transmittal for the resubmission.
 3. Indicate on drawings any changes which may have been made other than those requested by the Designer.
- C. Product Data and Samples:
1. Submit any new data and samples as required from previous submittal.

1.9 REVIEWS AND DISTRIBUTION OF SUBMISSIONS

- A. The Owner and LRTA Project Manager and any Owner designees will review submittals concurrently with the Engineer and his/her consultant engineers. The Engineer and the Owner shall communicate within the aforesaid review period time frame (fourteen calendar days). The time frame for the Engineer's review will not exceed fourteen calendar days between her/his receipt of submittal and contacting the Owner. After the Engineer's (and his/her consultant engineers) review, distribution shall be as stated herein.
1. If submittal is "APPROVED", "APPROVED AS CORRECTED", "REVIEWED – NO EXCEPTION TAKEN", or "REVIEWED, MAKE CORRECTIONS NOTED", the Engineer shall compose a transmittal indicating the status. The Engineer will then return one copy of the submittal together with the transmittal, shall retain one copy for her/his records, and transmit one copy directly to the Owner. The Contractor shall then distribute said submittals to appropriate subcontractors.
 2. If submittal is "REVISE AND RESUBMIT", "NOT APPROVED", "REVIEWED – REVISE AND RESUBMIT", or "REJECTED", the Engineer shall compose a transmittal indicating the status. The Engineer will then return one copy of the submittal for resubmission, shall retain one copy for her/his records, and transmit one copy directly to the Owner.
 3. The Engineer will process the submission and indicate the appropriate action on the submission and the transmittal. Incomplete or erroneous transmittals will be returned without action.
 4. The Engineer will fill out transmittal in the following sequence:
 - a. Date received from Contractor.
 - b. Date forwarded to LRTA Project Manager.
 - c. Date received from LRTA Project Manager.
 - d. Date returned to Contractor.
 - e. Action taken on submission.
 - f. Distribution, including number of copies distributed and type of material distributed (i.e., print, brochure or sample, etc.).
 - g. Engineer's remarks (note major deviations from the Contract Documents).

B. Engineer's Review Procedure:

1. Stamped APPROVED or REVIEWED – NO EXCEPTIONS TAKEN:
 - a. No corrections or resubmissions required, fabrication may proceed.
2. Stamped APPROVED AS CORRECTED or REVIEWED – MAKE CORRECTIONS NOTED:
 - a. If Contractor complies with noted corrections, fabrication may proceed. Submit corrected print for final review.
 - b. If, for any reason, the Contractor cannot comply with the noted corrections, fabrication shall not proceed and Contractor shall resubmit, following procedures outlined in this Section.
3. Stamped REVISE AND RESUBMIT, REVIEWED – REVISE AND RESUBMIT, NOT APPROVED OR REJECTED:
 - a. Contractor shall revise and resubmit for review. Fabrication shall not proceed.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 REQUIREMENTS INCLUDED

- A. Quality assurance.
- B. Contractor's responsibilities.
- C. Examination of substrate.

1.03 RELATED SECTIONS

- A. Section 01 3100 – PROJECT COORDINATION
 - 1. General project management and coordination

1.04 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions and workmanship to produce work of high quality as specified.
- B. Comply fully with manufacturer's instructions, including each step in sequence.
- C. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes or specified requirements indicate higher standards or more precise workmanship.
- D. Perform work by persons qualified to produce workmanship of specified quality.
- E. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortions or disfigurement. Anchorage devices shall be labeled to allow for visual inspection and verification of type of anchorage device.

1.05 MANUFACTURER'S REPRESENTATIVES

- A. If required; by specific specification sections, manufacturer's representative shall be present at the job site for supervision of work during installation of materials. Such representative shall be present during all aspects of construction to ensure proper installation of all applicable items. Refer to other sections of these specifications for additional requirements.

1.06 EXAMINATION OF SUBSTRATE

- A. Installers of materials, products or equipment shall do the following:
 - 1. Examine base surfaces upon which materials, products or equipment are to be installed.
 - 2. Examine conditions upon which materials, products or equipment are to be installed.
 - 3. Where there is any question as to the dryness of a surface, test with a modern moisture-indicating machine.
 - 4. Notify the Contractor, in writing, with a copy to the Engineer, if conditions are detrimental to proper and timely construction and completion of the work.
- B. Do not proceed with work until unsatisfactory substrate or unacceptable conditions have been corrected. Commencement of installation constitutes acceptance of substrate or base surfaces, and the cost of any corrective work due shall be borne by the installer applying his/her materials, products or equipment thereon.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not used

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract including, but not limited to, the following:
 - 1. Owner (Lowell Regional Transit Authority or LRTA).
 - 2. Owner's Project Manager (PM)
 - 3. The Engineer (AECOM USA of Massachusetts, Inc. (AECOM) or the Engineer-of-Record as applicable).
 - 4. The Contractor.
- B. "Reviewed": When used to convey PM & Engineer's action on Contractor's submittals, applications, and requests, "reviewed" is limited to PM & Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by PM or Engineer. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.

- I. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more-stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research’s “Encyclopedia of Associations” or in Columbia Books’ “National Trade & Professional Associations of the U.S.”
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of current edition of Codes in the Commonwealth of Massachusetts.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 4535

SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for Special Inspection and Testing Procedures.
- B. Special Inspection and Testing services as specified in this Section, and in accordance with the Statement of Special Inspections and Schedule of Special Inspections, are required by the governing Code for verification of the Contractor's compliance with the requirements of the Contract Documents.
- C. For this project the governing Code is the Massachusetts State Building Code (780 CMR), 10th Edition, which adopts Chapter 17 of the International Building Code (IBC) by the International Code Council (ICC) with modifications.
- D. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification.
- E. Work and services described in this Section do not relieve Contractor of its responsibilities to provide its own quality control and for compliance with the Contract Document requirements, nor do they relieve the Contractor of any testing and inspections required by other sections of the specifications.
- F. Work and services described in this Section are the responsibility of the Design Professional in Responsible Charge and shall not be included for payment to the Contractor, unless noted otherwise.
- G. Inspection and testing services described in this Section are to be performed by a third party, independent of the Contractor, with the results reported directly to the Owner or the Owner's Authorized Representative, and to the Design Professional in Responsible Charge.

1.2 DEFINITIONS

- A. Continuous Special Inspections
 - 1. Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.
- B. Perform
 - 1. Perform these tasks for each weld, fastener or bolted connection, and noted required verification.

C. Observe

1. Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Observe these Special Inspections items on a periodic daily basis. Operations need not be delayed pending these inspections.

D. Special Inspector (SI)

1. A qualified person retained by the Owner and approved by the Owner's Representative as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Owner.

E. Associate Special Inspector (ASI)

1. A qualified person who assists the SI in performing Special Inspections but who must perform inspection under the direct supervision of the SI and who cannot perform inspections without the SI on site.

F. Third Party

1. A Special inspector must not be an employee of the Contractor or of any Sub-Contractor performing the work to be inspected.

G. Special Inspector of Record (SIOR)

1. A licensed professional engineer in responsible charge of supervision of all special inspectors for the project and approved by the Owner's Representative. The SIOR must be an independent third-party entity hired directly by the Owner.

H. Owner's Representative

1. The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Owner's Representative's Representative (OR).

I. Quality Control (QC) Manager

1. An individual retained by the Prime Contractor and qualified in accordance with the Section 014500 "Quality Control" having the overall responsibility for the Contractor's QC organization.

J. Structural Engineer of Record (SER)

1. A registered design professional employed by the Owner responsible for the overall design and review of submittal documents prepared by others. The SER is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in the state in which the design professional works. The SER is also referred to as the Engineer of Record (EOR) in design documents.

- K. Statement of Special Inspections (SSI)
 - 1. A document developed by the SER identifying the materials, systems, components and work required to have Special Inspections. This statement is included at the end of this specification.
- L. Schedule of Special Inspections (SSI)
 - 1. A schedule which lists each of the required Special Inspections, the extent to which each Special Inspection is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17. This schedule is included at the end of this specification.
- M. Definable Feature of Work (DFOW)
 - 1. An inspection group that is separate and distinct from other inspection groups, having inspection requirements or inspectors that are unique.

1.3 ACTION SUBMITTALS

- A. Preconstruction Submittals:
 - 1. SIOR Letter of Acceptance
 - 2. Special Inspections Project Manual
- B. Certificates:
 - 1. Special Inspector of Record Qualifications
 - 2. Special Inspector Qualifications
- C. Closeout Submittals:
 - 1. Interim Report of Special Inspections from each DFOW.
 - 2. Comprehensive Final Report of Special Inspections.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Submittals:
 - 1. Special Inspections Agency's Written NDT Practices with method and evidence of regular equipment calibration where applicable
- B. Test Reports
 - 1. Special Inspection Daily Reports
 - 2. Special Inspection Biweekly Reports
- C. Certificates
 - 1. AISC Certified Steel Fabricator
 - 2. Certificate of Compliance
 - 3. Qualification Records for Nondestructive Testing Technicians

1.5 SPECIAL INSPECTOR QUALIFICATIONS

- A. Submit qualifications for each special inspector and the special inspector of record according to the following certification requirements. The Owner will consider alternate equivalent certification upon request though is not required to accept such alternate equivalent certification requirements. Without written acceptance, deviations to the following qualifications are not approved.
1. Concrete Construction
 - a. Special Inspector
 - 1) ICC Reinforced Concrete Special Inspector Certificate with one year of related experience, or
 - 2) ACI Concrete Construction Special Inspector, or
 - 3) Registered Professional Engineer with 3 years of related experience
 - b. Associate Special Inspector
 - 1) ACI Concrete Construction Special Inspector-in-Training, or
 - 2) Engineer-In-Training with one year of related experience
 2. Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements
 - a. Special Inspector
 - 1) ICC Soils Special Inspector Certificate with one year of related experience, or
 - 2) National Institute for Certification in Engineering Technologies (NICET) Soils Technician Level II Certificate in Construction Material Testing, or
 - 3) Geologist-In-Training with 3 years of related experience, or
 - 4) Registered Professional Engineer with 3 years of related experience
 - b. Associate Special Inspector
 - 1) NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or
 - 2) Engineer-In-Training with one year of related experience

PART 2 - PRODUCTS

2.1 SPECIAL INSPECTION OF FABRICATED ITEMS

- A. Special Inspection of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the following certifications to the Owner's Representative for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections. unless otherwise indicated.

- B. At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance with the construction documents.

PART 3 - EXECUTION

3.1 RESPONSIBILITIES

A. Quality Control Manager

1. Supervise all Special Inspectors required by the Contract Documents and the IBC.
2. Verify the qualifications of all the Special Inspectors.
3. Verify the qualifications of all fabricators.
4. Maintain a 3-ring binder for the Special Inspector's special inspection daily reports and special inspection biweekly reports. This binder must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the SER.
5. Maintain a rework items list that includes discrepancies noted on the Special Inspector's daily report.

B. Special Inspectors

1. Inspect all elements of the project which the special inspector is qualified to inspect and which are identified in the Schedule of Special Inspections.
2. Attend preparatory phase meetings related to the Definable Feature of
3. Work (DFOW) which the Special Inspector is qualified to inspect.
4. Submit Special Inspection agency's written NDT practices for the monitoring and control of the agency's operations, to include the following:
5. The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel.
6. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.
7. Submit Qualification Records for Nondestructive Testing Technicians for nondestructive testing (NDT) technicians designated for the project.
8. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.
9. Submit a copy of the special inspection daily reports to the QC Manager.

10. Report discrepancies that are observed during Special Inspections to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.
11. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:
 - a. A brief summary of the work performed during the reporting time frame.
 - b. Changes from and discrepancies with the drawings, specifications that were observed during the reporting period.
 - c. Discrepancies which were resolved or corrected.
 - d. A list of nonconforming items requiring resolution.
 - e. All applicable test result, including nondestructive testing reports.
 - f. At the completion of each DFW requiring Special Inspections, submit an interim report of Special Inspections that documents the Special Inspections completed for that DFW. Identify the inspector responsible for each item inspected and corrections of all discrepancies noted in the daily reports. The interim report of Special Inspections must be signed and dated and it must indicate the certification of the Special Inspector qualifying them to conduct the inspection.
 - g. At the completion of the project, submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed and dated and it must indicate the certification of the Special Inspector qualifying them to conduct the inspection.

3.2 DEFECTIVE WORK

- A. Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Owner's Representative to accept the defective work or materials.

END OF SECTION

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.
- C. Building plan indicating intended location of all construction barriers, enclosures, noise and dust control measures, and scaffolding. Provide intended date for erection and removal of all construction barriers, enclosures, noise and dust control measures, and scaffolding. Coordinate with approved Owner occupancy plan and schedule required under Section 013200 Schedules, Reports, and Payments and Owner restrictions on site usage as indicated on construction documents.

1.03 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, fire department and rescue squad rules
 - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition" and NECA Electrical Design Library "Temporary Electrical Facilities"
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electrical service. Install service in compliance with NFPA 70 "National Electric Code"
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.04 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

1.05 TEMPORARY UTILITIES AND SERVICES

- A. The Contractor shall furnish all utilities and services for all work performed in the Contract.
- B. Any temporary pipe lines and connections from permanent service lines either outside or within the site, necessary for the use of the Contractor shall be installed, protected, and maintained at the expense of the Contractor. The Contractor shall arrange to have these services metered and pay for the usage.
- C. The Contractor shall provide an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for his employees.

1.06 FIRE PROTECTION

- A. Provide and maintain adequate fire protection during the work.
- B. Gasoline and other flammable liquids shall be stored in and dispensed from UL listed safety containers in conformance with the National Board of Fire Underwriters' recommendations.
- C. Make arrangements for periodic inspection by local fire protection authorities and insurance underwriter inspectors. Cooperate with said authorities and promptly carry out their recommendations.
- D. Tarpaulins used during construction work shall be made of material which is resistant to fire, water, and weather. Tarpaulins shall have UL approval and meet approval of the Lowell Fire Department.
- E. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
- F. Provide and maintain adequate fire protection in the form of fire extinguishers, or other effective means of extinguishing fire, ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of work at the site.

1.07 WEATHER PROTECTION AND ENCLOSURES

- A. The Contractor shall be responsible for the protection of all materials and equipment for the project from the effects of wind, rain, snow, ice, sunlight, heat, and other weather related effects.
- B. Provide temporary, insulated, weather-tight closures of openings in exterior surfaces for providing acceptable working conditions and protection for materials, allowing for heating during construction, and preventing entry of unauthorized persons. Provide doors with self-closing hardware and locks.
- C. All utilities including electric ducts, conduits, telephone lines, sprinklers, and other utilities shall be protected against damage from construction activity. The Contractor shall be responsible for all damage to the utilities from construction and shall repair all such damage at no additional cost to the Owner.

1.08 TEMPORARY ELECTRIC POWER

- A. Electrical energy for temporary light and power will be made available without charge. Make necessary arrangements, through the Owner, for temporary electrical service locations.
- B. The Contractor shall furnish all temporary lighting, extension cords, sockets, motors, and accessories required for his work. The Contractor shall pay for all temporary wiring needed for his field office.
- C. Temporary Electrical Service for the site shall include, but not be limited to:
 - 1. All labor, materials, and equipment necessary to supply temporary power or adequate capacity for Project operations and testing.
 - 2. Transformers and meters, when required by the power company will be furnished and installed by the appropriate power company; pay all costs.
 - 3. Perform all temporary electrical work under the direct supervision of at least one Master Electrician, who shall be present on the Project at all items when electrical work is being performed.
 - 4. Use copper wire only.
- D. Temporary Lighting: Provide temporary lighting with local switching. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. All relocations of temporary service to meet construction and/or phasing requirements shall be performed at no additional cost to the Owner.

1.09 DUST CONTROL

- A. The Contractor shall provide adequate means for the purpose of preventing dust caused by construction operations from creating a hazard or nuisance, and from entering adjacent occupied areas throughout the period of the construction contract.
- B. The Contractor shall submit a dust control plan to the Engineer for approval.

1.10 NOISE CONTROL

- A. Develop and maintain a noise-abatement program to enforce strict discipline over all personnel to keep noise to a minimum. Comply with the City of Lowell's Noise Ordinance.
- B. Execute construction work by methods and by use of equipment which will reduce excess noise.
 - 1. Equip air compressors with silencers, and power equipment with mufflers.
 - 2. Manage vehicular traffic and scheduling to reduce noise.
 - 3. No heavy equipment may be started or idled before 7:00 a.m.

1.11 FIELD OFFICE

- A. Owner will provide interior space for a field office when required to be on-site.
- B. The Contractor shall maintain the office in a clean and orderly fashion on a daily basis.

1.12 SANITARY FACILITIES

- A. The Contractor shall be responsible for providing and maintaining sufficient sanitary facilities for the use of the Contractor's forces. Such facilities shall be located within the Project limits and shall be maintained in a manner acceptable to the LRTA's Project Manager and the Engineer.
- B. Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
- C. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- D. A maintenance plan of the Sanitary Facilities shall be submitted to the Engineer for approval.

1.13 SITE SECURITY

- A. Maintain the existing perimeter fencing system to fully secure the site for the duration of the Contract. The Contractor is solely responsible for the full security of the work site.

1.14 TEMPORARY WATER

- A. Water for use during construction shall be furnished by the Contractor from the Owner's water system.
- B. Any temporary hoses and pipe lines and connections from the permanent service lines either outside or within the garage, necessary for the use of the Contractor and his subcontractors shall be installed, protected, and maintained at the expense of the Contractor.
- C. Temporary hoses and temporary pipe lines used for transporting water shall not be run unattended or unprotected across parking areas, parking area entrance, walkways, plazas, steps, or inside the garage. Temporary hoses and temporary pipelines shall not be permitted to be installed along, through, or across corridor and occupied rooms or spaces.
- D. Use of the water may be discontinued by the Owner if, in the opinion of the Owner, it is wastefully used.

1.15 ENCLOSURE

- A. Provide temporary enclosure for protection of construction, in progress and completed, where reasonably required to ensure adequate workmanship and protection from weather, exposure, other construction operations, unsatisfactory ambient conditions for the work, and similar activities including enclosure if temporary heat is used. Provide fire-retardant treated lumber and plywood. Provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where day-lighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
- B. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- C. Install tarpaulins securely, with incombustible wood framing and other materials.
- D. Close openings through floor or roof decks and horizontal surfaces with load-bearing construction.

1.16 HEATING

- A. Provide temporary heating as required throughout the garage at levels where concrete placement operations are being conducted such that the temperature of the curing concrete does not fall below a 55°F, or higher temperature where reasonably required for the work. Heat with self-contained fuel oil heaters, bearing UL, FM, or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls.

1.17 HOISTING EQUIPMENT AND MACHINERY

- A. Comply with OSHA for all hoists, conveyers, and elevators and maintain the facility in compliance with the law.
- B. All hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the work shall be furnished, installed, operated, and maintained in safe condition by the Contractor for the use of all subcontractors' material and/or equipment delivered to the designated hoisting area except that which is specifically required to be provided by the subcontractors themselves and is so stated in each appropriately related Section of the Specifications. All costs for hoisting operating services shall be borne by the Contractor unless specifically accepted in the Contract Documents.
 - 1. A licensed equipment manufacturer's representative shall be present at all times, to witness the erection and dismantling of all hoisting equipment and machinery, whenever such equipment is being erected or dismantled. No such work will be performed without the presence of such representative.
 - 2. Hoisting equipment and machinery erection and dismantling shall be performed only by trained, certified and experienced riggers qualified to perform such work.
 - 3. Copies of such licenses and/or certifications, clearly indicating qualifications, shall be provided to the Owner prior to commencement of such erecting and dismantling work.
- C. Review Drawings for hoisting requirements and openness of traffic access routes to installed destinations of specified equipment and furnishings.

1.18 ACCESS PROVISIONS

- A. Provide ramps, stairs, ladders, and similar temporary access elements as reasonably required to perform the work and facilitate its inspection during installation. Comply with reasonable requests of governing authorities performing inspections.

1.19 SCAFFOLDING AND STAGING

- A. All staging, exterior and interior, required to be over 8 ft in height, shall be furnished and erected by the Contractor and maintained in safe condition by him without charge to and for the use of all trades as needed by them for proper execution of their work, except where specified to the contrary in any filed sub-bid Section of the Specification.
 - 1. Erection and dismantling of staging shall be performed only by trained, certified, and experienced staging personnel qualified to perform such work.
 - 2. Staging shall conform to federal, state, and local requirements.
 - 3. Copies of such certifications, clearly indicating qualifications, shall be provided to the Owner prior to commencement of such erecting and dismantling work.
- B. Any staging that is up to 8 ft in height shall be furnished and erected by the applicable subcontractor.

1.20 WASTE MANAGEMENT PLAN

- A. Develop a waste management plan for Work performed on the Project. Indicate the types of waste material the Project will produce and estimate quantities of each type. Provide detailed information on the on-site waste storage and separate of recyclable rubbish and debris separate categories. Provide information on the destination of each type of waste material and the means to be used to dispose of all waste material.
- B. Collection and Disposal of Waste: The Contractor shall be responsible for the collections of waste from construction area and elsewhere daily as required. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

1.21 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures, and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Owner requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repairs.
 - 1. Materials and facilities that constitute temporary facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housing.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

1.22 MAINTENANCE OF ACCESS

- A. The Contractor shall provide and maintain for the duration of his contract, a means of access to, around and within the site, as indicated on the Contract Drawings, for vehicular traffic and authorized personnel both for the Contractor and Owner. This means of access shall be construed to sustain the weight of equipment customarily engaged for use in construction projects of this type and magnitude. The General Contractor shall, without additional compensation from the Owner, furnish labor and materials as may be required from time to time to maintain this means of access in an acceptable condition as determined by the Project Manager and Engineer. Pedestrian access shall provide adequate protection against falling debris, slippage, adequate lighting, warning and directional signs, and protection against construction activities.

1.23 CONSTRUCTION BARRIERS

- A. Proper construction barriers shall be provided around the contract work areas as defined as directed by the Owner.
- B. Construction barriers shall consist of traffic cones, ribbons, tapes, wood barriers, warning signs, directional signs, and other traffic materials to keep traffic from area of construction.
- C. Barriers shall be erected at such approved locations as are necessary, sufficiently cross-braced and supported adequately from floors and ceilings as required.

1.24 PARKING

- A. Only during contract working hours and to the extent available, existing parking facilities located at the construction area will be available for use by the General Contractor, subcontractors and their employees. Such parking areas shall be designated by Owner. The Owner shall not be responsible for cars, trucks, etc., or their contents and the Contractor and his subcontractors and material suppliers will use the designated area with this understanding.

1.25 SAFETY PROTECTION

- A. At no time shall the work be left unattended without proper safety protection and shall not be left unprotected to the weather and accessible to the public. It is the responsibility of the General Contractor to maintain proper safety protection for the public while work is in progress or unattended.

1.26 VEHICLE AND EQUIPMENT PROTECTION

- A. All construction activities shall be performed in such a manner so as not to dust, stain or damage any building elements, equipment, vehicles, etc., within general vicinity of the construction work area. Any damage to these items shall be cleaned and repaired at the expense of the Contractor.

1.27 SHORING

- A. Provide all temporary shoring and bracing as required for the proposed work. Comply with all applicable codes and standards. Plans and details for shoring, stamped by Engineer licensed in Massachusetts, shall be submitted for approval.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including and all other Division 1 Specifications which are hereby made a part of this section.

1.02 DESCRIPTION OF REQUIREMENTS

- A. Definitions: Definitions used in this Paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as “specialties”, “systems”, “structure”, “finishes”, “accessories”, “furnishings”, “special construction”, and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.
 - 1. “Products” are items purchases for incorporation into the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor’s previously purchases stock. The term “product” as used herein includes the terms “material”, “equipment”, “system”, and other terms of similar intent.
 - a. “Named Products” are products identified by use of the manufacturer’s name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.
 - 2. “Materials” are products that must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.
 - 3. “Equipment” is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that required service connections such as wiring or piping.
- B. Substitutions: The Contractor’s requests for changes in the products, materials, equipment, and methods of construction required by the Contract Documents are considered requests for “substitution”, and are subject to the requirements specified herein. The following are not considered as substitutions:
 - 1. Revisions to the Contract Documents, where requested by the Owner or Engineer are considered as “changes”, not substitutions.

2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.
 3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitution as herein specified.
 4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by the governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.
- C. Standards" Refer to Division 1 Section "References" for the applicability of industry standards to the products specified for the project.

1.03 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.
1. When it is discovered that specified products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Engineer for a determination of what product qualities are most important before proceeding. The Engineer will designate those qualities, such as visual, structural, durability, or compatibility, that are most important. When the Engineer's determination has been made, select products from those sources that product products that possess the most important qualities, to the fullest extent possible.
- B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

1.04 SUBMITTALS

- A. Substitution Request Submittal:
1. Requests for Substitutions: Submit the number of copies required in Section 013300 Submittal Requirements for each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related specification section and drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include the following information, as appropriate, with each request.

- a. Provide complete product data, drawings, and description of products, and fabrication and installation procedures.
 - b. Provide samples where applicable or requested.
 - c. Provide a detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities include elements such as size, weight, durability, performance, and visual effect where applicable.
 - d. Provide complete coordination information. Include all changes required in other elements of the work to accommodate the substitution, including work performed by the Owner and separate Contractors.
 - e. Provide a statement indicating the effect the substitution will have on the work schedule in comparison to the schedule without approval of the proposed substitution. Include information regarding the effect of the proposed substitution on the Contract Time.
 - f. Provide complete cost information, including a proposal of the net change, if any, in the Contract Sum.
 - g. Provide certification by the Contractor to the effect that, in the Contractor's option, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated.
 - 1) Include in this certification the Contractor's waiver of rights to additional payment or time, which may subsequently be necessary because of the failure of the substitution to perform adequately
- B. Change Order Form: Submit requests for substitutions in the form and in accordance with the procedures required for change order proposals.
1. LRTA Project Manager Action: Within fifteen (15) days of receipt of the Contractor's request for substitution, the LRTA Project Manager will request additional information or documentation as may be needed for evaluation of the request. Within thirty (30) days of receipt of the request, or within fifteen (15) days of receipt of the requested additional information or documentation, whichever is later, the LRTA Project Manager will notify the Contractor of either the acceptance or rejection of the proposed substitution.
 2. Acceptance will be in the form of a signed and approved change order
 3. Rejection will include a statement giving reasons for the rejection.

1.05 TRANSPORTATION AND HANDLING

- A. Refer to the Contract and General Conditions and Specifications Sections for requirements pertaining to transportation and handling of materials and equipment.

- B. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturers' unopened containers or packaging, dry.
- C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- D. Promptly inspect shipments to ensure that products comply with requirements, that quantities are correct, and that products are undamaged.

1.06 STORAGE AND PROTECTION

- A. Refer to the Contract and General Conditions and Specifications Sections for requirements pertaining to storage and protection of materials and equipment.
- B. Store products in accordance with manufacturers' instruction, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturers' instructions.
- C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- E. Arrange storage to provide access for inspection. Periodically inspect to ensure that products are undamaged and are maintained under required conditions.
- F. Protect masonry and stone products from damage and staining.
- G. Protect finished materials, including window frames and doors, with protection acceptable to the Owner.
- H. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCE

- A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:
 - 1. Proprietary
 - 2. Descriptive
 - 3. Performance

4. Compliance with Reference Standards
 - a. Compliance with codes, compliance with graphic detail, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process.
- B. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction products. Required procedures include but are not limited to the following for the various indicated methods of specifying:
- C. Semi-proprietary Specification Requirements
 1. Two or More Product Names: Where two or more products or manufacturers are named, provide one of the products named, at the Contractor's option. Exclude products that do not comply with specification requirements. Do not provide or offer to provide an unnamed product, unless the specification indicates possible consideration of other products. Advise the Engineer before proceeding where none of the named products comply with specification requirements or are feasible to use.
 - a. Where products or manufacturers are specified by name, accompanied by the term "or equal" or similar language, comply with the Contract Document provisions concerning "substitutions" to obtain approval from the LRTA Project Manager for the use of an unnamed product. The mention of products by trade name or manufacturer, with the designation "or equal", "or equivalent", "or product meeting specified requirements", is intended to convey to the Contractor that degree of excellence required. The products of manufacturers other than those named will in such cases be accepted if, to the best of the Project Manager and Engineer's knowledge, information, and belief, they are equal in strength, durability, usefulness, suitability, performance, and convenience for the purpose intended. The Project Manager with advice from the Engineer shall be the sole judge of the qualifications of such products and will determine all questions regarding the conformation of any products with the Project Manual. Any changes required in the details and dimensions as shown on the Drawings for the substitution of standard products shall be properly made as approved by the Engineer and at the expense of the Contractor.
 2. Non-Proprietary Specification Requirements: Where the specification name products that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may, at his option, use any available product that has the exact characteristics of the specified product and otherwise comply with Contract requirements.
 3. Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand or trade name, provide products or assemblies that provide the characteristics indicated and otherwise comply with Contract requirements.

4. Performance Specification Requirements: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.
5. Compliance with Standards, Codes, and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including standards, codes, and regulations.
6. Visual Matching: Where matching an established sample is required, the final judgment of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Project Manager with the advice of the Engineer. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of the Contract Documents concerning "substitutions" and "change orders" for the selection of a matching product in another product category, or for non-compliance with specified requirements.
7. Visual Selection: Except as otherwise indicated, where specified product requirements include the phrase "...as selected from the manufacturer's standard colors, patterns, textures..." or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The Engineer is subsequently responsible for select the color, pattern, and texture from the product line selected by the Contractor.

2.02 SUBSTITUTIONS

- A. Conditions: The Contractor's request for a substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the requests are timely, fully documented, and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Project Manager and Engineer; otherwise the requests will be returned without except to record non-compliance with these requirements:
 1. The Project Manager and Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.
 2. The Project Manager and Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

3. The Project Manager and Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 4. The Project Manager and Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation, or other considerations of merit, after deducting of offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Project Manager and Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.
 5. The Project Manager and Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.
 6. The Project Manager and Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.
 7. The Project Manager and Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.
- B. Work-Related Submittals: The Contractor's submittal of and the Project Manager and Engineer's of shop drawings, product data, or samples which related to work not complying with the requirements of the Contract Documents, does not constitute an acceptance or valid request for a substitution, nor approval thereof.

2.03 GENERAL PRODUCT REQUIREMENTS

- A. General: Provide products that comply with the requirements of the Contract Documents that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
- B. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- C. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

- D. Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.
- E. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
- F. Equipment Nameplates: Provide a permanent nameplate on each items of service-connected or power-operated equipment. Locate the nameplate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.
 - 1. Name of manufacturer
 - 2. Name of product
 - 3. Model number
 - 4. Serial number
 - 5. Capacity
 - 6. Speed
 - 7. Ratings
- G. Do not use materials and equipment removed from existing structures, except as specifically required, or allowed, by the Contract Documents.
- H. In the case of an inconsistency between Drawings and the Project Manual, or within either document that is not clarified by addendum, the product of greater quality or greater quantity of work shall be provided in accordance with the Engineer's interpretation.
- I. Workmanship
 - 1. Comply with industry standards except when more-restrictive tolerances or specified requirements indicate more-rigid standards or more-precise workmanship.
 - 2. Perform work by persons qualified to produce workmanship of specified quality.
 - 3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

END OF SECTION

SECTION 01 6100

SAFETY

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including and all other Division 1 Specifications which are hereby made a part of this section.

1.02 DESCRIPTION OF WORK

- A. Work Included: Without intending to limit or restrict the extent of Work involved, the work includes:
 - 1. The preparation and implementation of a Contractor's Health and Safety Plan

1.03 MEASUREMENT AND PAYMENT

- A. Health and safety will not be measured for payment.
- B. All costs for health and safety shall be included in the unit costs or lump sum prices for work requiring health and safety work. No separate measurement will be made for work required in this Section.

1.04 SAFETY AND HEALTH PLAN

- A. Construction site safety is the sole responsibility of the Contractor.
- B. Comply with *Safety and Health Requirements Manual (EM 385-1-1)* latest edition, published by the U.S. Army Corps of Engineers (USCOE). Copies of EM 385-1-1 may be obtained from the Government Printing Office: Superintendent of Documents, Government Printing Office Washington DC 20402-9325, phone: 202-783-3238.
- C. Conduct work to prevent any laborer, mechanic, or other employee from exposure to conditions that are unsanitary, hazardous, or dangerous to health and safety, as determined under construction safety and health standards promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.) as amended. Construction safety and health standards promulgated by the Secretary of Labor may be obtained by the regional or area office of the Occupational Safety and Health Administration of the U.S. Department of Labor.

- D. Immediately correct violations of the safety and health requirements contained in these specifications or standards referenced above. Notification of violations noted by the LRTA Project Manager, Owner or Engineer may be verbal or written. Failure of the Owner or Engineer to provide notification of health or safety violations does not relieve the Contractor from responsibility for conformance with the regulations and safety of personnel and property.
- E. If the contractor fails to promptly correct violations of the safety and health standards and requirements, noted by the Owner, the Owner will issue and order to stop all or part of the work. When satisfactory corrective action is taken, an order to resume work will be issued. The Contractor shall not be entitled to any extension of time, nor to any claim for damage or additional compensation by reason of either the notification of a violation or the stop work order.

1.05 SUBMITTALS

- A. Submit Contractor's Health and Safety Plan. The Safety and Health Plan submittal is for information and records purposes. The Engineer and Owner will not review the Safety and Health Plan. Work will not be allowed to proceed prior to receipt of the Health and Safety Plan.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01 7700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Attention is directed to the Drawings and general provisions of the Contract, including all other Division 1 Specifications which are hereby made a part of this section.

1.02 DESCRIPTION OF REQUIREMENTS

- A. Definitions: Project closeout is the term used to describe certain collective project requirements, indicating completion of the work that is to be fulfilled near the end of the Contract Time in preparation for final acceptance and occupancy of the work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.
 - 1. Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 16.
 - 2. Time of closeout is directly related to “Substantial Completion”; therefore, the time of closeout may be either a single time period for the entire work or a series of time periods for individual elements of the work that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this section.

1.03 PREREQUISITES TO SUBSTANTIAL COMPLETION

- A. General: In addition to the requirements in the General Conditions complete the following before requesting the Project Manager and Engineer’s inspection for certification of substantial completion, either for the entire work or for portions of the work. List known exceptions in the request.
 - 1. In the progress payment request that coincides with or is the first request following the date substantial completion is claimed, show either 100% completion for the portion of the work claimed as “substantially complete”, or list incomplete items, the value of incomplete work, and reasons for the work being incomplete.
 - 2. Include support documentation for completion as indicated in these Contract Documents.

3. Submit a statement showing an accounting of changes to the Contract Sum.
 4. Advise Owner of pending insurance change-over requirements.
 5. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, and similar documents.
 6. Obtain and submit releases enabling Owner's full, unrestricted use of the work and access to services and utilities. Where required, include occupancy permits, operating certificates, and similar releases. Obtain the required inspections and releases by local building officials.
- B. Inspection Procedures: Upon receipt of Contractor's request for inspection, the Owner will either proceed with inspection or advise Contractor of unfulfilled prerequisites.
1. Following the initial inspection, the Owner will either prepare the certificate of substantial completion or will advise Contractor of work which must be performed before the certificate will be issued. The Owner will repeat the inspection when requested and when assured that the work had been substantially completed.
 2. Results of the completed inspection will form the initial "punchlist" for final acceptance.

1.04 PREREQUISITES TO FINAL ACCEPTANCE

- A. General: Complete the following before requesting the Owner's final inspection for certificate of final acceptance, and final payment as required by the General and Supplementary Conditions. List known exceptions, in any, in request.
1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Owner's final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Owner.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of substantial completion, or else

when the Owner took possession of and responsibility for corresponding elements of the work.

5. Submit consent of surety.
 6. Submit a final liquidated damages settlement statement, acceptable to Owner.
 7. Submit evidence of final, continuing coverage complying with insurance requirements.
 8. Complete with requirements indicated in Specification Section 013200 Schedules, Reports, Payments.
- B. Re-inspection Procedure: The Owner will re-inspect the work upon receipt of the Contractor's notice that the work, including punchlist items resulting from earlier inspections, has been completed, except for those items whose completion has been delayed because of circumstances that are acceptable to the Owner.
1. Upon completion of re-inspection, the Owner will either prepare a certificate of final acceptance or will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.
 2. If necessary, the re-inspection procedure will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Specific requirements for record documents are indicated in the individual sections of the Specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in "submittals" sections.
1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.
- B. Record Drawings: Maintain a record set of blue or black line white prints of contract drawings and shop drawings in a clean, undamaged condition. Mark-up the set of record documents to show the actual installation where the installed work varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawing are used for mark-up record a cross-reference at the corresponding location on the contract drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil, and, where feasible, use other colors to distinguish between variations in separate categories of work.
 2. Mark-up new information which is known to be important to the Owner, but for some reason was not shown on either contract drawings or shop drawings.
 3. Note related change order number where applicable.
 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each set.
 5. Upon completion of the work, submit record drawings to the Engineer for the Owner's records.
- C. Record Specifications: Maintain one complete copy of the Project Manual including specifications and addenda, and one copy of other written construction documents such as change orders, and similar modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual work performed in comparison with the text of the specifications and modification as issued. Give particular attention to substitutions, selection of options, and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable.
1. Upon completion of the work, submit record specifications to the Engineer for the Owner's records.
- D. Record Product Data: Maintain one copy of each product data submittal. Mark these documents to show significant variations in the actual work performed in comparison with the submitted information. Include both variations in the products as delivered to the site, and variations from the manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observation. Note related change orders and mark-up of record drawings and specifications.
1. Upon completion of mark-up, submit complete set of record product data to the Engineer for the Owner's records.
- E. Record Sample Submittal: Immediately prior to date or dates of substantial completion, the Contractor will meet at the site with the LRTA Project Manager, Engineer and the Owner's personnel, if desired, to determine which, if any, of the submitted samples that have been maintained by the Contractor during progress of the work, are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's sample storage space.

- F. Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous recordkeeping and submittals in connection with the actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the LRTA Project Manager for the Owner's records.
- G. Operation and Maintenance Manual: Comply with the requirements indicated in Specification Section 013300 Submittals. Submit to the LRTA Project Manager for the Owner's records.

1.06 GUARANTEES AND WARRANTIES

- A. Submit to the LRTA Project Manager & Engineer all extended guarantees and warranties that have been specified in various, individual Sections of the Specifications. Guarantees shall be assembled by Specification No. and Section in accordance with Specifications Table of Contents.
 - 1. Guarantees and warranties shall be enforceable in the Commonwealth of Massachusetts and subject to interpretation in accordance with the laws of the Commonwealth of Massachusetts.
- B. Unless more-stringent requirements are otherwise specified, guarantee all work against defects of materials, equipment, and workmanship for one year from the Date of Completion or the date of issue of Certificate of Use/Occupancy for the building or portion thereof, whichever occurs first.
- C. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, Contractor shall promptly upon receipt of notice from Owner, and without additional expense to Owner, within ten days:
 - 1. Place in satisfactory condition in every particular all guaranteed work and correct all defects.
 - 2. Make good all damage to building, site equipment, or contents thereof, including redecoration that, in the opinion of the Project Manager, results from the use of material, equipment, or workmanship that are inferior, defective, or not in accord with the terms of the Contract.
- D. If Contractor, after such notice, fails to proceed immediately to comply with terms of guarantee, Owner may correct defects and hold Contractor liable for all expenses incurred.
- E. Promptly after completion of the work, obtain from each subcontractor where a guarantee is required, a warranty addressed to and in favor of the Owner.

- F. Delivery of any warranty required does not relieve the Contractor from any obligation assumed under other provisions of the Contract.
- G. Deliver guarantees and warranties to the LRTA Project Manager before or with the application for Final Payment.
- H. The general warranty set forth in the General Conditions is in addition to, exclusive of, and not in substitution of such guarantees as may be required in the Specifications.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Special cleaning requirements for specific units of work are included in the appropriate sections of Division 2 through 33. General cleaning during the regular progress of the work is required by the General Conditions and is also included in other Contract Documents.
- B. Cleaning: Provide final cleaning of the work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected for a normal, commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.
 - 1. Complete the following cleaning operations before requesting the Engineer's inspection for certification of substantial completion.
 - 2. Remove labels which are not required as permanent labels.
 - 3. Clean transparent materials, including mirrors and glass in doors and windows, to a polished condition.
 - 4. Clean exposed exterior and interior hard-surface finishes to a dust-free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - 5. Wipe surfaces of mechanical and electrical equipment clean. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

6. Clean the project site, including landscape development areas, of rubbish, litter, and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- C. Pest Control: Engage an experienced exterminator to make a final inspection of the project and to rid project of rodents, insects, and other pests.
- D. Removal of Protection: Except as otherwise indicated or requested by the Engineer, leave in place those temporary protection devices and facilities which were installed during the course of the work.
- E. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste material at the site. Do not bury debris or excess material on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage system. Remove waste materials from the site and dispose of in a lawful manner.
- F. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these to the Owner's best advantage as directed.

END OF SECTION

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including all Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
- B. Related Requirements:

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.
- C. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- D. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: Product data must be provided with a short description, in writing, of where and how the submitted product(s) are proposed to be used in the project Work. Product data not meeting this requirement will be rejected without review.

For each of the following:

1. Exposed surface form-facing material.
 2. Concealed surface form-facing material.
 3. Form ties.
 4. Form-release agent.
- B. Sustainable Design Submittals: None
- C. Shop Drawings: None.
- D. Samples: None.

1.6 INFORMATIONAL SUBMITTALS

- A. None.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
1. Provide continuous, true, and smooth concrete surfaces.
 2. Furnish in largest practicable sizes to minimize number of joints.
 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.

- b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

2.3 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- E. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than to the plane of exposed concrete surface than the minimum clear cover indicated on the drawings.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface. All holes to be repaired per the requirements of 033000 "Cast-in-Place Concrete".

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301 (ACI 301M).
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .

- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25 mm).
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch (6 mm).
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch (3.0 mm).
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (305 mm).
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect and Engineer prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
 - 3. Place joints perpendicular to main reinforcement.

- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of foundations and equipment pads, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 03 2000

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including all Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.
- B. Related Requirements:
 - 1. inspection in addition to tests and inspections required by the Specifications, for which the Contractor is responsible.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.5 ACTION SUBMITTALS

Product Data: Product data must be provided with a short description, in writing, of where and how the submitted product(s) are proposed to be used in the project Work. Product data not meeting this requirement will be rejected without review.

For the following:

1. Each type of steel reinforcement.
 2. Zinc repair material.
 3. Bar supports.
 4. Mechanical splice couplers.
- B. Sustainable Design Submittals:
1. None.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of Architect and Engineer.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Material Test Reports: For the following, from a qualified testing agency:
1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
- C. Field quality-control reports.
- D. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage and to avoid damaging coatings on steel reinforcement.
1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Galvanized Reinforcing Bars:
 - 1. Steel Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed bars.
 - 2. Zinc Coating: ASTM A767/A767M, Class II zinc coated after fabrication and bending.
- C. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice, 30th Edition" and CRSI's "Reinforcing Bar Placing, 10th Edition" of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - b. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.
 - 1. Finish: Galvanized.
- C. Zinc Repair Material: ASTM A780/A780M.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice 30th Edition" and CRSI's "Placing Reinforcing Bars, 10 Edition."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice, 30th Edition" and CRSI's "Placing Reinforcing Bars, 10 Edition." for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318 (ACI 318M) and as specified on the Drawings, whichever is greater.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
 - 2. Stagger splices in accordance with ACI 318 (ACI 318M).
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice, 30th Edition" and CRSI's "Placing Reinforcing Bars, 10 Edition."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.
- H. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material in accordance with ASTM A780/A780M.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Engineer.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports indicated in the Statement and Schedule of Special Inspections. Special Inspections are in addition to tests and inspections required by the Specifications, for which the Contractor is responsible. Refer to 014535 “Special Inspections”.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including all Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete standards.
 - 2. Concrete materials.
 - 3. Admixtures.
 - 4. Liquid floor treatments.
 - 5. Curing materials.
 - 6. Accessories.
 - 7. Repair materials.
 - 8. Concrete mixture materials.
 - 9. Concrete mixture class types.
 - 10. Concrete mixing.
- B. Related Requirements:
 - 1. Section 014535 "Special Inspections" for code-required third-party testing and inspection in addition to tests and inspections required by the Specifications, for which the Contractor is responsible.
 - 2. Section 031000 "Concrete Forming and Accessories" for form-facing materials..
 - 3. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:
 - 1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.
- C. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

- D. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Cold- and hot-weather concreting procedures.
 - e. Concrete finishes and finishing.
 - f. Curing procedures.
 - g. Forms and form-removal limitations.
 - h. Concrete repair procedures.
 - i. Concrete protection.
 - j. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
 - k. Protection of field cured field test cylinders.
 - l. Distribution of test reports.

1.5 ACTION SUBMITTALS

- A. Product Data: Product data must be provided with a short description, in writing, of where and how the submitted product(s) are proposed to be used in the project Work. Product data not meeting this requirement will be rejected without review.

For each of the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.

5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral fillers.
10. Admixtures:
 - a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.
11. Vapor retarders.
12. Liquid floor treatments.
13. Curing materials.
14. Joint fillers.
15. Repair materials.

B. Sustainable Design Submittals:

1. None.

C. Design Mixtures: Design mixtures must be provided with a short description, in writing, of where and how the submitted product(s) are proposed to be used in the project Work and identify the appropriate Concrete Mix Class, as defined in "Concrete Mixtures" article. Design mixtures not meeting this requirement will be rejected without review.

For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Compressive strength required at stages of construction.
4. Durability exposure classes for Exposure Categories F, S, W, and C.
5. Maximum w/cm ratio.
6. Maximum limit from the time of initial mixing to complete discharge.
7. Slump or slump flow limit.
8. Air content.
9. Nominal maximum aggregate size.
10. Synthetic microfiber content.
11. Amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Intended placement method.
13. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

D. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.
3. Exposure class designation.
4. Formed surface finish designation and final finish.
5. Final finish for floors.
6. Floor treatment, if any.

E. Placement Schedule: Submit before start of placement operations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
 - 1. Installer: Include copies of applicable ACI certificates.
 - 2. Ready-mixed concrete manufacturer.
 - 3. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.
- B. Material Certificates: For each of the following:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Fiber reinforcement.
 - 4. Curing compounds.
 - 5. Floor and slab treatments.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Semirigid joint filler.
 - 9. Joint-filler strips.
 - 10. Repair materials.
- C. Material Test Reports: For the following:
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Silica fume.
 - 5. Natural or other pozzolans.
 - 6. Aggregates.
 - 7. Ground calcium carbonate and aggregate mineral filler.
 - 8. Admixtures.
- D. Research Reports:
 - 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- E. Preconstruction Test Reports: For each mix design.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Architect/Engineer.
 - 1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Evaluation of permeability-reducing admixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) as follows:
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When air temperature has fallen to, or is expected to fall below 40 deg F (4.4 deg C) during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.

- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Sustainable design – regional materials requirements:
1. None.
- B. Source Limitations:
1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 2. Obtain each type of admixture from single source from single manufacturer.
- C. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type I/Type II.
 2. Pozzolans: Fly Ash ASTM C618, Class F.
 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 4. Ground Glass Pozzolan: ASTM C1866/C1866M, Type GS or GE.
 5. Silica Fume: ASTM C1240.
- D. Normal-Weight Aggregates:
1. Coarse Aggregate: ASTM C33/C33M, Class 3S
 2. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 3. Fine Aggregate: ASTM C33/C33M.
 4. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.

- c. Alkali Content in Concrete: Not to exceed 4 lb./cu. yd. (2.37 kg/cu. m) for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or 3 lb./cu. yd. (1.78 kg/cu. m) for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with ACI 301 (ACI 301M). Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.
- E. Ground Calcium Carbonate or Aggregate Mineral Filler: ASTM C1797. Unless otherwise permitted, do not use mineral filler derived from carbonate sources in concrete for members assigned to Exposure Class S1, S2, or S3.

2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260/C260M.
- B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.
 - 7. Set-Accelerating Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.
 - 8. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline or colloidal silica admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).
 - a. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRD C48 at a hydraulic pressure of 200 psi (1.28 MPa) for 14 days.
 - 9. Moisture-Vapor-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, moisture-vapor-reducing, capable of reducing water absorption in and moisture-vapor emission from concrete (MVRA).
 - 10. Color: As selected by Architect from manufacturer's full range.
- C. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

2.4 LIQUID FLOOR TREATMENTS (SEALER/HARDENER)

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- D. Curing Paper: 8 ft. (2438 mm) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- E. Water: Potable water that does not cause staining of the surface.
- F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
- G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B.
- H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating.
- I. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
- J. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.6 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Floor Slab Protective Covering: 8 ft. (2438 mm) wide cellulose fabric.

2.7 CONCRETE MIXTURE MATERIALS

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).
1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete assigned to Exposure Class F3 as follows:
1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Silica Fume: 10 percent by mass.
 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
 2. Use permeability-reducing admixture in concrete mixtures where indicated.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXTURE CLASS TYPES

- A. Class A: Not applicable.
- B. Class B: Normal-weight concrete used for equipment pads.
1. Exposure Class: ACI 318 (ACI 318M) Class F3, S0, W2, C2.
 2. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
 3. Maximum w/cm Ratio: 0.40.
 4. Slump Limit: Target Slump selected by Contractor in accordance with ASTM C143/C143M and included in Design Mixtures submittal; minimum 4 inches (100 mm), plus or minus 1 inch (25 mm); maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm). Mix must meet the target slump plus or minus 1 inch (25 mm) for concrete at point of delivery.

- a. Exposure Classes F2 and F3: 6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.
- 5. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- 6. Include corrosion-inhibiting admixture.
- C. Class C: Not applicable.
- D. Class D: Not applicable.
- E. Class E: Not Applicable
- F. Class F: Not applicable.
- G. Class G: Not applicable.
- H. Class H: Not applicable.
- I. Class I: Not applicable.
- J. Class J: Not applicable.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

- A. Comply with ACI 117 (ACI 117M).

3.4 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items, is complete and that required inspections, and any corrective actions, are completed.
- B. Notify Architect and Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Concrete delivery:
 1. Use only trucks with drums that are thoroughly clean and free of concrete and deleterious materials from prior mix batches before reloading the drum with concrete materials. Clean-out and wash truck drums as required.
 2. A maximum limit from the time of initial mixing to complete discharge shall be established by the Contractor with the concrete manufacturer in accordance with the requirements of ASTM C94/C94M. Maximum limit established must be provided on the Concrete Design Mixture submittal and must be stated on the concrete delivery ticket.
 3. Concrete discharged beyond the maximum limit established from time of initial mixing will not be accepted.
- D. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth and placement rate not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
 - a. Do not use vibrators to transport concrete inside forms.

- b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for sidewalks and walkways in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete sidewalks and walkways in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.5 INSTALLATION OF JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with sidewalk or walkway pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect and Engineer.
 - 2. Place joints perpendicular to main reinforcement or as shown on Drawings.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch (3-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 APPLICATION OF FINISHING FLOORS AND SLABS

- A. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
 3. Apply float finish to surfaces [to receive trowel finish] [and] [to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo] <Insert locations>.

B. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces [exposed to view] [or] [to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system] <Insert locations>.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 1) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
 - 2) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.
 - 3) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.
 - 4) Specified overall values of flatness, F_F 50; and of levelness, F_L 35; with minimum local values of flatness, F_F 40; and of levelness, F_L 24.

C. Trowel and Fine-Broom Finish: First apply a trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.7 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1 inch (25 mm).
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 (ACI 117M), Class D.
 - e. Apply to concrete surfaces for metal lap pan deck formed surfaces and those surfaces that are buried or covered with subsequent installed surfaces.
2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1/4 inch (6 mm).
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 (ACI 117M), Class B.
 - e. Locations: Apply to concrete surfaces unless otherwise noted.
3. ACI 301 (ACI 301M) Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1/8 inch (3 mm).
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
 - e. Locations: Apply to concrete surfaces exposed to public view.

B. Rubbed Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part Portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white Portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.

- f. Maintain required patterns or variances as shown on Drawings or to match mockups.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:

- 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
- 2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
- 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Miscellaneous Equipment Bases and Foundations:

- 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
- 2. Construct concrete bases 6 inches (150 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
- 3. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
- 4. Install dowel rods to connect concrete base to concrete foundations. Unless otherwise indicated, install dowel rods on 6-inch (450-mm) centers around the full perimeter of concrete base.
- 5. For supported equipment, install galvanized or stainless steel anchor bolts that extend through concrete base and anchor or post-install into structural concrete substrate.
- 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- 1. Comply with ACI 301 (ACI 301M) for cold weather protection during curing.

2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305R, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Begin curing after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).

- b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.

3.10 APPLICATION OF LIQUID TREATMENTS, INCLUDING PENETRATING SEALERS

- A. Penetrating Liquid Treatment: Prepare, apply, and finish penetrating liquid treatment in accordance with manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than number of days' old indicated within manufacturer's printed installation instructions.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 - 4. Rinse with water; remove excess material until surface is dry.
 - 5. Apply a second coat in a similar manner if surface has received a float finish or abrasive surface preparation.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.11 INSTALLATION OF JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one six month.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 - 1. Repair and patch defective areas when approved by Architect and Engineer.
 - 2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch (0.25 mm) spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch (19 mm).
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and match surrounding surface.
 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Architect and Engineer.
- D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
 3. After concrete has cured at least 14 days, correct high areas by grinding.
 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect and Engineer's approval.

3.13 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports indicated in the Statement and Schedule of Special Inspections. Special Inspections are in addition to tests and inspections required by the Specifications, for which the Contractor is responsible. Refer to 014535 “Special Inspections”.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
 - 2. Testing agency to immediately report to Architect, Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301 (ACI 301M), including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Copies of truck and batch delivery tickets.
 - 11) Design compressive strength at 28 days.
 - 12) Concrete mixture designation, proportions, and materials.
 - 13) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
 - 14) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
 - 15) Type of fracture and compressive break strengths at seven days and 28 days.

4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.
- C. Delivery Tickets: comply with ASTM C94/C94M.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect and Engineer.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 150 cu. yd. (114 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
 3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample when strength test specimens are cast.
6. Concrete Density: ASTM C138/C138M:
 - a. One test for each composite sample when strength test specimens are cast.
7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and standard cure two sets of three 6 inches (150 mm) by 12-inches (300 mm) or 4-inch (100-mm) by 8-inch (200-mm) cylindrical specimens for each composite sample.
 - b. Cast, and field cure two sets of three standard cylindrical specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of three standard cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of three field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

- b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.7.6.3.
- 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

- 1. Protect from petroleum stains.
- 2. Diaper hydraulic equipment used over concrete surfaces.
- 3. Prohibit use of pipe-cutting machinery over concrete surfaces.
- 4. Prohibit placement of steel items on concrete surfaces.
- 5. Prohibit use of acids or acidic detergents over concrete surfaces.
- 6. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
- 7. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

END OF SECTION

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 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. Encore Wire Corporation.
2. Service Wire Co.
3. Southwire Co.
4. Or Engineer approved equal.

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 THHN and Type THWN-2: Comply with UL 83.
2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
3. Type XHHW-2: Comply with UL 44.

2.02 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. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. 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

3.01 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.
 2. Copper, Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- 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."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- 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.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inch (300 mm) of slack.

3.05 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.

3.06 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."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
 - a. Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
 - b. Include recommended testing intervals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.02 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B3.
 - 2. Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. 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.

2.03 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- D. Conduit Hubs: Mechanical type, terminal with threaded hub.
- E. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- F. Straps: Solid copper, copper lugs. Rated for 600 A.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 ft. (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 1. Bury at least 30 inch (750 mm) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode must be connected to the equipment grounding conductor and to the frame of the generator.

3.04 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch (50 mm) above to 6 inch (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inch (150 mm) from the foundation.

3.05 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Receptacle circuits.
 - 3. Flexible raceway runs.
 - 4. Armored and metal-clad cable runs.

3.06 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inch (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.07 FIELD QUALITY CONTROL

A. 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 a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any 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 according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
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.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

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.
4. 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.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.01 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.

2.02 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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB Electrification Installations Products.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Atkore Unistrut.
 - d. Or Engineer approved equal.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Stainless steel, Type 304.
 - 4. Channel Width: Selected for applicable load criteria.
 - 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.
- B. Conduit and Cable Support Devices: Steel 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:
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.
 - 3) MKT Fastening, LLC.
 - 4) Or Engineer approved equal.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless 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) Cooper B-line; brand of Eaton, Electrical Sector.
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 3. Or Engineer approved equal. 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.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.01 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA NEIS 101
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as scheduled in NECA NEIS 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.
- D. 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 single-bolt conduit clamps using spring friction action for retention in support channel.

3.02 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this section.
- B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC and ERM as scheduled in NECA NEIS 1, EMT IMC and ERM may be supported by openings through structure members, in accordance with NFPA 70.
- C. 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 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:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.

- 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 6. To Light Steel: Sheet metal screws.
 - 7. 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.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type ERMCS raceways, elbows, couplings, and nipples.
2. Type ERMCS raceways, elbows, couplings, and nipples.
3. Type PVC raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Threaded metal joint compound.
6. Solvent cements.
7. Wireways and auxiliary gutters.
8. Metallic outlet boxes, device boxes, and covers.
9. Termination boxes.
10. Cabinets, cutout boxes, junction boxes, and pull boxes.
11. Cover plates for device boxes.

PART 2 - PRODUCTS

2.01 TYPE ERMCS RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Stainless Steel Electrical Rigid Metal Conduit (ERMCSS), Elbows, Couplings, and Nipples:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 6A and UL Category Control Number DYWV.
 - 2) Material: Stainless steel.
- c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).

2.02 TYPE ERM-C-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Galvanized-Steel Electrical Rigid Metal Conduit (ERM-C-S-G), Elbows, Couplings, and Nipples:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 6 and UL Category Control Number DYIX.
 - 2) Exterior Coating: Zinc.
 - 3) Interior Coating: Zinc.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).
 - 2) Colors: As indicated on Drawings.
- B. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERM-C-S-PVC), Elbows, Couplings, and Nipples:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 6 and UL Category Control Number DYIX.
 - 2) Exterior Coating: PVC complying with NEMA RN 1 and marked ETL Verified PVC-001.
 - 3) Interior Coating: Zinc.
 - 4) Fittings for PVC-Coated Conduit:
 - a) Minimum coating thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
 - b) Conduit bodies must be Form 8 with an effective seal and a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours must be available. Conduit bodies must be supplied with plastic-encapsulated stainless steel cover screws.
 - c) Form 2 inch (51 mm) long or one pipe diameter long, whichever is less, PVC sleeve at openings of female fittings, except unions. Inside sleeve diameter must be matched to outside diameter of metal conduit.

- d) PVC coating on the outside of conduit couplings must be protected from tool damage during installation.
 - e) Female threads on fittings and couplings must be protected by urethane coating.
 - f) Fittings must be from same manufacturer as conduit.
 - g) Beam clamps and U bolts must be formed and sized to fit outside diameter of coated conduit. Plastic-encapsulated nuts must cover the exposed portions of threads.
- c. Options:
- 1) Minimum Trade Size: 3/4 inch (21 mm).
 - 2) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - 3) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.03 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Applicable Standards:
- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Schedule 40.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).
 - 2) Markings: For use with maximum 90 deg C wire.

B. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Applicable Standards:
- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Schedule 80.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).
 - 2) Markings: For use with maximum 90 deg C wire.

C. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Type A.
- c. Options:
 - 1) Minimum Trade Size: 3/4 inch (21 mm).

D. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Type EB.
- c. Options:
 - 1) Minimum Trade Size: 4 inch (103 mm).

2.04 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERM, Type IMC, and Type PVC Raceways:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DWTT.
 - 2) Material: Steel.
 - 3) Coupling Method: Raintight compression coupling with distinctive color gland nut.
- c. Options:
 - 1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - 2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

B. Fittings for Type EMT Raceways:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number FKAV.
 - 2) Material: Steel.
 - 3) Coupling Method: Compression coupling.
- c. Options:
 - 1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - 2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

C. Fittings for Type FMC Raceways:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number ILNR.

D. Fittings for Type LFMC Raceways:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.05 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Applicable Standards:

- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and approved by authorities having jurisdiction for application to threaded conduit assemblies.
- 2. General Characteristics:
 - a. Reference Standards: UL 2419 and UL Category Control Number FOIZ.

2.06 SOLVENT CEMENTS

A. Solvent Cements for Type PVC Raceways and Fittings:

1. Applicable Standards:
 - a. General Characteristics:
 - 1) Reference Standards: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.
 - b. Sustainability Characteristics:

2.07 METALLIC OUTLET BOXES, DEVICE BOXES, AND COVERS

A. 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. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.
 - c. Options:
 - 1) Material: Sheet steel, Cast metal.
 - 2) Sheet Metal Depth: Minimum 2 inch (50 mm).
 - 3) Cast-Metal Depth: Minimum 2.4 inch (60.3 mm).

B. 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. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.
 - c. Options:
 - 1) Material: Sheet steel , Cast metal.
 - 2) Sheet Metal Depth: minimum 2 inch (50 mm).
 - 3) Cast-Metal Depth: minimum 2.4 inch (60.3 mm).

2.08 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. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
 - 2) Listed and labeled for installation on line side of service equipment.
- C. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
 - 2) Listed and labeled for installation on load side of service equipment.

2.09 CABINETS, CUTOOT BOXES, JUNCTION BOXES, AND PULL BOXES

A. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.

B. Indoor Sheet Metal Cutout Boxes:

1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.

C. Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
- c. Options:
 - 1) Degree of Protection: Type 1.

D. Indoor Cast-Metal Junction and Pull Boxes:

- 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
- 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.

E. Outdoor Sheet Metal Cabinets:

- 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
- 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.

c. Options:

- 1) Degree of Protection: Type 3R.

F. Outdoor Sheet Metal Cutout Boxes:

1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.

G. Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.

H. Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.

2.10 COVER PLATES FOR DEVICES BOXES

A. Metallic Cover Plates for Device Boxes:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Wallplate-Securing Screws: Metal with head color to match wallplate finish.
 - c. Options:
 - 1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - 2) Wallplate Material: 0.032 inch (0.8 mm) thick Type 302/304 non-magnetic stainless steel with brushed finish.

PART 3 - EXECUTION

3.01 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 Engineer for resolution of conflicting requirements.

B. Outdoors:

1. Exposed Conduit: PVC-40.
2. Concealed Conduit, Aboveground: ERM, PVC-40.
3. Direct-Buried Conduit: PVC-40.
4. Concrete-Encased Conduit Not in Trench: PVC-40.
5. Concrete-Encased Conduit in Trench: PVC-40.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Hazardous Classified Locations: ERM.
2. Exposed and Subject to Physical Damage: ERM. Raceway locations include the following:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
3. Exposed, Not Subject to Physical Damage: ERM.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: ERM.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

D. Stub-ups to Above Recessed Ceilings: Provide EMT, IM, or ERM for raceways.

E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERM and IM: Provide threaded type fittings unless otherwise indicated.

3.02 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 6P.
- c. Locations Subject to Potential Flooding: Type 6P.
- d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
- e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
- f. 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 12.
 - c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12K.
 - e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 - f. Locations Exposed to Hosedown: Type 6P.
 - g. Locations Exposed to Brief Submersion: Type 6P.
 - h. Locations Exposed to Prolonged Submersion: Type 6P.
 - i. Locations Exposed to Corrosive Agents: Type 4X.
 - j. Locations Exposed to Spraying Oil or Coolants: Type 13.
- C. Exposed Boxes Installed Less Than 6.5 ft. (2 m) Above Floor:
 1. Provide cast-metal boxes. Boxes with knockouts or unprotected openings are prohibited.
 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.03 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 Engineer 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. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
 7. 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.
 8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch (35 mm) trade size and insulated throat metal bushings on 1-1/2 inch (41 mm) trade size and larger conduits terminated with locknuts.

9. 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. 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.
4. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
5. Support conduit within 12 inch (300 mm) of enclosures to which attached.
6. 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.
7. 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.
8. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
9. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
10. 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.
11. Cut conduit perpendicular to the length. For conduits 2 inch (53 mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

12. 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. Raceways Embedded in Slabs:

1. Run raceways larger than 1 inch (27 mm) trade size below concrete slab..
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 2 inch (50 mm) of concrete without voids.

D. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERM C 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. ERM C-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, steel 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.

F. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft. (7.6 m). Install in runs of aboveground ERM C conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft. (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- G. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.04 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum 2 inch (50 mm) radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch (1200) mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.05 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. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. 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.
- M. 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.

3.06 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.07 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.

3.08 CLEANING

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

END OF SECTION

SECTION 26 0544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Round sleeves.
 - 2. Rectangular sleeves.
 - 3. Sleeve seal systems.
 - 4. Grout.
 - 5. Pourable sealants.
 - 6. Foam sealants.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

- A. Wall Sleeves, Steel:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, LLC.
 - b. CCI Piping Systems.
 - c. Flexicraft Industries.
 - d. GPT Industries, LLC.
 - e. Specified Technologies Inc.
 - f. Or Engineer approved equal.
 - 2. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- B. Pipe Sleeves, PVC:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CCI Piping Systems.
 - b. GPT Industries, LLC.
 - c. Metraflex Company (The).
 - d. Or Engineer approved equal.
 - 2. Description: ASTM D1785, Schedule 40.

C. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Benefast.
 - b. Specified Technologies Inc.
 - c. Wiremold; Legrand North America, LLC.
 - d. Or Engineer approved equal.
2. Description: 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.

2.02 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

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.
 - d. Roxtec Inc.
 - e. Or Engineer approved equal.
2. Description:
 - 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).

2.03 SLEEVE SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, LLC.
 2. Flexicraft Industries.
 3. GPT Industries, LLC.
 4. Roxtec Inc.
 5. Or Engineer approved equal.

- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway 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: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.04 GROUT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Specified Technologies Inc.
 - 2. W. R. Meadows, Inc.
 - 3. SpecChem
 - 4. Or Engineer approved equal.
- B. 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 (34.5 MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.05 POURABLE SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carlisle SynTec Systems; a Carlisle Company.
 - 2. GAF.
 - 3. Johns Manville; a Berkshire Hathaway company.
 - 4. Specified Technologies Inc.
 - 5. Or Engineer approved equal.
- B. 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.

2.06 FOAM SEALANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Polywater Corporation.
 - 2. Innovative Chemical Products (Building Solutions Group).
 - 3. The Dow Chemical Company.
 - 4. Or Engineer approved equal.
- B. 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

3.01 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 inches (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. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- D. 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.
- E. Underground, Exterior-Wall and Floor Penetrations:
 - 1. Install steel 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 sleeve seal system. Install sleeve during construction of floor or wall.
 - 2. 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.

3.02 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.

3.03 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.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall 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.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 5. Color for Neutral: White or gray.
 - 6. Color for Equipment Grounds: Green.
 - 7. Colors for Isolated Grounds: Green two or more yellow stripes.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall 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 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.03 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.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Seton Identification Products; a Brady Corporation company.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter 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. Seton Identification Products; a Brady Corporation company.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl 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. Brother International Corporation.
 - c. Panduit Corp.
 - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, 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. Brady Corporation.
 - b. Brother International Corporation.
 - c. Panduit Corp.

2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameter and that stay in place by gripping action.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. HellermannTyton.
 - c. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a 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.
 - c. Electro Insulation Corporation
 - d. Or Engineer approved equal.

2.05 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. Brady Corporation.
 - b. HellermannTyton.
 - c. Panduit Corp.
 - d. Or Engineer approved equal.

- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (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. Carlton Industries, LP.
 - c. emedco.
 - d. Or Engineer approved equal.
- C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HellermannTyton.
 - b. Pipemarker.com; Brimar Industries, Inc.
 - c. Seton Identification Products; a Brady Corporation company.
 - d. Or Engineer approved equal.
- 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 one of the following:
 - a. Brady Corporation.
 - b. Carlton Industries, LP.
 - c. Seton Identification Products; a Brady Corporation company.
 - d. Or Engineer approved equal.
- E. Underground-Line Warning Tape:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Brady Corporation.
 - b. Ideal Industries, Inc.
 - c. Pipemarker.com; Brimar Industries, Inc.
 - d. Seton Identification Products; a Brady Corporation company.
 - e. Or Engineer approved equal.

2. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.06 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services Inc.
 - c. emedco.
 - d. Or Engineer approved equal.
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 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Marking Services Inc.
 - c. emedco.
 - d. Or Engineer approved equal.

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 inches (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. Brady Corporation.
 - b. Marking Services Inc.
 - c. Seton Identification Products; a Brady Corporation company.
 - d. emedco.
 - e. Or Engineer approved equal.
2. Engraved legend.
3. Thickness:
 - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting or Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.07 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. HellermannTyton.
 2. Marking Services Inc.
 3. Panduit Corp.
 4. Or Engineer approved equal.
- 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) according to 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) according to 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) according to 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.

2.08 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

3.01 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. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. 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.

- H. System Identification for Raceways and Cables under 600 V: Identification shall 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.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "STANDBY POWER."
 - 2. "POWER."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface 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.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
 - 1. On each unit of equipment, 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- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using plenum-rated cable ties.
- Y. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a 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 inches (50 mm) high.
- Z. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a 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 inches (50 mm) high.
- AA. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a 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 inches (50 mm) high.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.02 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. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl tape applied in bands.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 1. "STANDBY POWER."
 2. "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.
- H. 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.

- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall 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.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel 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.
- M. Operating Instruction Signs: Baked-enamel warning signs.
- N. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- O. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION

SECTION 26 2213

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 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. 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.

1.03 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Electrification Installations Products.
 - 2. Eaton.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; Schneider Electric USA.
 - 5. Or Engineer approved equal.

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- E. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
- F. Coils: Continuous windings without splices except for taps.
 - 1. Coil Material: Copper.
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Welded.
- G. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated.
 - 1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
- D. Taps for Transformers 3 kVA and Smaller: None.
- E. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

- F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- G. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- J. Wall Brackets: Manufacturer's standard brackets.

2.04 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written 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 shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

3.02 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Secure transformer to concrete base according to manufacturer's written instructions.
- C. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- D. Remove shipping bolts, blocking, and wedges.

3.03 CONNECTIONS

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

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

- c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- E. Remove and replace units that do not pass tests or inspections and retest as specified above.
- F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.05 CLEANING

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

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.04 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.06 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
 - 2. Height: 84 inches (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 shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: Convertible between top and bottom.

- G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Siemens Industry, Inc., Energy Management Division.
 - 3. Square D; Schneider Electric USA.
 - 4. Or Engineer approved equal.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices: Fused switches.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Siemens Industry, Inc., Energy Management Division.
 - 3. Square D; Schneider Electric USA.
 - 4. Or Engineer approved equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Siemens Industry, Inc., Energy Management Division.
 - 3. Square D; Schneider Electric USA.
 - 4. Or Engineer approved equal.
- 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 front-mounted, 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 shall be recorded with type, phase, and magnitude of fault that caused the 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. Subfeed Circuit Breakers: Vertically mounted.
8. 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. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.05 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 407.
- C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. 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.
- H. Install filler plates in unused spaces.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a 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.

- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS. 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.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Wall plates.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Owner unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Essential Electrical System: Red.
 - 3. SPD Devices: Blue.
- F. Wall Plate Color: For plastic covers, match device color.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.03 STANDARD-GRADE RECEPTACLES, 125 V, 15 A

A. Duplex Receptacles, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Weather-Resistant Duplex Receptacle, 125 V, 15 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.04 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.05 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Unfinished Spaces: Galvanized steel.
3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Device Installation:
 - 1. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 3213.13

DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes packaged engine-generator sets for Standby power with the following features:
 - 1. Diesel engine
 - 2. Cooling system
 - 3. Control and monitoring with connections to building BMS
 - 4. Performance requirements for sensitive loads
 - 5. Fuel system
 - 6. Alternator, exciter, and voltage regulator
 - 7. Battery and battery charger
 - 8. Outdoor enclosure
 - 9. Exhaust
 - 10. Mounting
 - 11. Air make-up system
 - 12. Vibration isolation devices
- A. Related Requirements:
 - 1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.02 REFERENCES

- A. The following codes and standards are referenced throughout this section. Specific items of required compliance are listed within each article.
- B. International Electrotechnical Commission (IEC)
 - 1. IEC 60034 – Rotating electrical machines.
 - a. Part 1: Rating and performance
- C. International Organization for Standardization (ISO)
 - 1. ISO 3046 - Reciprocating Internal Combustion Engines – Performance
 - 2. ISO 8528 - Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets

- D. National Electrical Manufacturers Association (NEMA)
 - 1. NEMA MG1 – Motors and Generators
- E. National Fire Protection Association (NFPA)
 - 1. NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
 - 2. NFPA 70 – National Electrical Code.
 - 3. NFPA 99 – Health Care Facilities Code.
 - 4. NFPA 110 – Standard for Emergency and Standby Power Systems.
- F. Underwriters Laboratories, Inc. (UL)
 - 1. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - 2. UL 2200 – Standard for Stationary Engine Generator Assemblies.

1.03 WORK INCLUDED

- A. Installation: The work includes supplying and installing a complete integrated generator system. The system consists of a diesel generator set with related component accessories.
- B. Fuel System: The contractor shall provide a full tank of diesel fuel for the completion of all testing.
- C. System Test: A complete system load test shall be performed after all equipment is installed.
- D. Requirements, Codes and Regulations: The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a manufacturer who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of package engine generator indicated. Drawings and descriptive (catalog) data and brochures of each item of equipment including technical data sheets for the engine and generator.
 - 1. Diesel engine data:
 - a. Manufacturer and model
 - b. Revolutions per minute (rpm)
 - c. Rated capacity brake horsepower (bhp)
 - d. Make and model of governor
 - e. Engine displacement
 - f. Fuel consumption rate in gallons per hour at: full load, 3/4 load, 1/2 load

2. Generator Data (Main Alternator): Submit generator manufacturer's data sheet for the exact generator arrangement included in this scope. Generator data shall include:
 - a. Generator specifications
 - b. Kilowatt and kVA ratings, line and phase voltages, and rated current
 - c. Generator efficiency at 25%, 50%, 75%, and 100% of kilowatt rating
 - d. Generator reactance and time constants
 - e. Stator and field resistances
 - f. Short circuit ratio
 - g. Voltage regulation performance
 - h. Excitation voltage and current, at no-load and full-load conditions
 - i. Generator center of gravity XYZ locations
 - j. Generator, rotor, and stator weights
 - k. Rotor balance deflection, in mm
 - l. Overspeed capacity, expressed as % of synchronous speed
 - m. Generator torsional data for coupling and fan, rotor, exciter end, and shaft stiffness
 - n. Insulation class
 - o. Generator thermal limits in kVA for:
 - 1) Class B, F, and H temperature rises over 40°C ambient in continuous duty (BR - base rating): B BR 80/40, F BR 105/40, H BR 125/40
 - 2) Class F and H temperature rises over 40°C ambient in standby duty (PR - peak rating): F PR 130/40, H PR 150/40
 - 3) Class H temperature rise over 27°C ambient in standby duty (PR - peak rating): H PR27
 - p. Motor starting capability chart at 0.4 p.f. (% voltage dip v. skVA)
 - q. Instantaneous fault currents (3-phase, line-line, and line-neutral)
 - r. Current decrement data curve (instantaneous 3-phase fault current v. E time cycle)
 - s. Generator output characteristic curves:
 - 1) Open circuit curve (line-line voltage v. field current)
 - 2) Short circuit curve (armature current v. field current)
 - 3) Zero power factor curve (line-line voltage v. field current)
 - 4) Air gap curve (line-line voltage v. field current)
 - 5) Reactive capability curve
3. Package data:
 - a. Overall length, width, and height
 - b. Weight of complete skid mounted unit
 - c. Exhaust pipe size
 - d. Air flow of air required for combustion and ventilation
 - e. Heat rejection to the atmosphere of the engine and generator in BTU/hr
 - f. Cooling air volume required
 - g. Emissions certification
 - h. Sound data

4. Engine-generator unit and accessories to include:
 - a. Enclosure
 - b. Accessory sub-panel & transformer
 - c. Control panels
 - d. Voltage regulator
 - e. Fuel system
 - f. Exhaust system
 - g. Batteries
 - h. Battery charger
 - i. Jacket water heater
 5. Generator circuit breaker:
 - a. Catalog data
 - b. Recommended trip settings for all adjustable settings
 - c. Short circuit interrupt ratings
- A. Shop Drawings:
1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Identify fluid drain ports and clearance requirements for proper fluid drain.
 4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
 6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer and testing agency.
- B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.
- C. Source quality-control test reports:
 1. Certified summary of prototype-unit test report.
 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Report of factory tests on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 4. Report of sound generation.
 5. Factory EPA Certificate showing compliance with applicable federal regulations.
 6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- D. Field quality-control reports.
- E. Warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
1. Recommended service intervals, fluid sampling, and inspections.
 2. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
 3. Operator training plan

1.07 MAINTENANCE MATERIAL

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Filters: One set each of lubricating oil, fuel, and combustion air filters

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
1. Maintenance Proximity: Not more than 4 hours' normal travel time from Installer's place of business to Project site.
 2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer with a minimum of 25 years' experience building the generator sets. The manufacture shall actively maintain a 24-hour parts and service organization regularly engaged in maintenance contract programs to perform preventive maintenance and service on equipment like that specified.

- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with ASME B15.1.
- F. Comply with NFPA 37.
- G. Comply with NFPA 70.
- H. Comply with NFPA 99.
- I. Comply with NFPA 110 requirements for Level 1 and Level 2 emergency / legally required power supply systems.
- J. Listed to UL 2200 (600V generator output and below)
- K. Exhaust Emissions: Comply with applicable federal, state, and local emissions requirements at the time of installation and commissioning.
- L. Sound emissions: Comply with applicable local sound requirements

1.09 WARRANTY

- A. Extended Service Coverage
 - 1. Extended Service Coverage shall be provided for a period of 5 years or 2500 running hours and shall include no deductible. Extended Warranty Coverage provides for 100% of usual and customary parts and labor costs for failures due to defects in materials and workmanship to the “as shipped bill of material” from the factory, excluding filters, fluids, vee belts, hoses, power take-offs, paint, batteries and clutches. All repairs will be performed by factory trained dealer service personnel and allows for repairer travel and mileage for all repairs up to 8 hours and 320 miles (515 km) per incident. Extended service coverage shall include the ability to be extended in 5-year increments for up to 20 years total coverage.
 - 2. Extended Service Coverage shall include a temporary generator set in the event a covered repair will take more than 48 hours. Selling dealer must have a minimum of 100 units in its rental fleet to assure a temporary unit is available if needed. Provide documentation as such.

1.10 MAINTENANCE SERVICE

- A. The engine generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project.

- B. Initial Maintenance Service: Beginning at Acceptance, provide 12 months' full maintenance by certified employees of manufacturer's designated service organization. Include semi-annual exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
- C. Preventive Maintenance Agreement: The authorized manufacturer's dealer shall provide a preventive maintenance agreement using qualified factory trained service personnel, for a period of 10-year minimum. The authorized manufacturer's dealer shall provide genuine OEM parts and filters, shall provide all recommended fluids, dealer labor, travel labor and travel mileage to complete the suggested preventive maintenance as defined in the manufacturer's Operation and Maintenance Manual. Includes the following fluid sampling:
 - 1. Service Oil Sampling
 - a. Key element analysis which includes both wear metals and oil additives
 - b. Viscosity of all oils
 - c. Check for outside contamination from water, diesel fuel, or antifreeze
 - d. Oil Condition
 - e. Oil cleanliness analysis with Particle count technology
 - 2. Coolant Sampling
 - a. Key element analysis to determine if the coolant has the right chemical balance for maximum protection and cooling efficiency.
 - b. Sampling assess correct usage, condition, adequate freeze/boil protection, and contamination.
 - c. Minimizes engine damage caused by overheating due to inefficient cooling
 - 3. Diesel Fuel Sampling
 - a. Key element analysis to ensure optimum performance of your equipment
 - b. Check for acceptable fuel quality, microbial growth, contamination, and appropriate usage.
 - c. Minimize abnormal wear of components, valves, valve guides, piston rings, and more
 - d. Minimize maintenance and operating costs.
- D. Inspection App: Equipment manufacturer to provide complementary app to inspect and document inspection data. The app shall include the following:
 - 1. Access to standard inspections forms like Preventative Maintenance, Checklists and Daily Walk Arouds
 - 2. Create custom check lists and inspection forms
 - 3. Document asset condition with photos, videos and inspector comments
 - 4. Red, Yellow, Green ratings allow for quick identification of actionable items
 - 5. Web interface for viewing inspection data and managing inspection forms

6. Conduct Equipment, Site and fluid Inspections
7. Assign inspections to team members and evaluate the results from online at anytime
8. View Inspection Results - Inspect integrates with other Equipment Management applications
9. Optimized for mixed fleet owners – secure inspection results for assets all in one place
10. Inspection Data Integration – Completed inspection data made available for analysis through Partner API (Application Program Interface)
11. Real-Time Information – digital inspections provide real-time information for review and retention.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Caterpillar, Inc.; Electric Power Division.
 2. Cummins Power Generation.
 3. Rehlko.
 4. Rolls-Royce Solutions America Inc.
 5. Or Engineer approved equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Engine generator housing, subbase fuel tank, day tank, engine generator, batteries, battery racks, silencers, load banks, sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels. Water shall be substituted for diesel fuel in fuel tank during test.
 3. Component Importance Factor: 1.0.
- B. B11 Compliance: Comply with B11.19.

C. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 2 EPSS.

D. UL Compliance: Comply with UL 2200.

E. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.

F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

H. Unusual Service Conditions: Engine generator equipment and installation are required to operate under the following conditions:

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. New, factory assembled and tested engine-generator set.

B. The electric power generating system shall consist of 250 kW, 0.8 power factor, 480 volts, Wye connected, Three Phase, 4 wire, 60 hertz generator systems.

C. Motor starting at 90% rated sustained voltage will not be accepted. Generator set shall be rated for Standby applications with typical usage of 500 hours per year.

D. Service Load: 375 kVA.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 480-V ac.

H. Phase: Three-phase, four wire, wye.

I. Governor: Adjustable isochronous, with speed sensing.

- J. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.
- K. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- L. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- M. Engine Generator Performance:
1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
 8. Start Time:
 - a. Comply with NFPA 110, Type 10 system requirements.

2.04 DIESEL ENGINE

- A. Fuel: Fuel oil, Grade DF-2 ULS type.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: Engine or skid-mounted.
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 - 2. Lube oil pump
 - 3. Oil level regulator
 - 4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System:
 - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
 - 3. Provide water separator and fuel filters. Fuel filters shall have isolation valve for changing of filters during engine operation.
- E. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499 and with NFPA 110 requirements for Level 1 equipment for heater capacity.
- F. Governor: Shall provide isochronous control, with provisions to interface with load share modules and / or remote switchgear. The engine governor shall be an electronic Engine Control Module (ECM) with 24-volt DC Electric Actuator. The ECM shall be enclosed in an environmentally sealed, die-cast aluminum housing which isolates and protects electronic components from moisture and dirt contamination. The ECM shall adjust fuel delivery per exhaust smoke, altitude and cold mode limits. In the event of a DC power loss, the forward acting actuator will move to the minimum fuel position.
- G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump
 - 1. Coolant: As recommended by engine manufacturer.
 - 2. Size of Radiator: The cooling system shall be sized to operate at full load conditions and 104°F (40°C) ambient air entering the room or enclosure (If an enclosure is specified). The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equipped with gage glass and petcock.
 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 6. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
 7. Integral fuel oil cooler shall be provided as required by the OEM.
- H. Muffler/Silencer: Semicritical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 18 dB at 500 Hz.
 2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 78 dBA or less.
- I. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- J. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: A lead-acid storage battery set shall be provided. Battery voltage shall be compatible with the starting system.
 - a. Battery Charger: A UL listed/CSA certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float and equalize charge settings, with provisions to automatically switch between the two modes. It shall maintain its rated output voltage within $\pm 0.2\%$ with AC input variation of $\pm 10\%$. Operational monitors shall provide with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of battery charger malfunction, low battery voltage, and high battery voltage. Charger shall include an Analog DC voltmeter and ammeter and fused AC input and DC output, and shall be wall mount type in a NEMA 1 enclosure.

5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

2.05 DIESEL FUEL-OIL SYSTEM

- A. Comply with NFPA 37.
- B. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- C. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- D. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- E. Fuel-Oil Storage Tank: As required for specific installation per all local codes and regulations.
 1. Fuel Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 72 hours' operation at 100 percent of rated power output of engine generator system without being refilled.
- F. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
 1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
 2. Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 72 hours' operation at 100 percent of rated power output of engine-generator system without being refilled.
 3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.

4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 5. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
 6. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
 7. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor-control device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine generator.
- G. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
1. Tank level indicator.
 2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for planned operation plus fuel for periodic maintenance operations between fuel refills.
 3. Leak detection in interstitial space.
 4. Vandal-resistant fill cap.
 5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.06 CONTROL AND MONITORING

- A. Provides a fully solid-state, microprocessor based, auto start / stop generator set control module which is fully configurable via PC using USB and RS485 ModBus communication. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to engine ECU/ECM via CAN SAE J1939.
- B. Environmental: The generator set control shall be tested and certified to the following environmental conditions:
 1. -22°F to +158°F (-30°C to +70°C) Operating Range
 2. 68°F to +131°F (20°C to 55°C) at 95% relative humidity for 48 hours (BS EN 60068-2-30, BS EN 60068-2-78)
 3. IP65 for front of module when installed in the control panel using sealing gasket
 4. Vibration at 2G, 8-500 Hz (BS EN 60068-2-6)
 5. Electromagnetic capability (BS EN 61000-6-2, BS EN 61000-6-4)
 6. Shock: withstand 15G (BS EN 60068-2-27)

C. Functional Requirements: The following functionality shall be integral to the control panel:

1. The control shall include 132 x 64-pixel, 2.9 inch x 1.8 inch (75 mm x 45.5 mm) 4-line LCD display
2. LCD alarm with text-based alarm/event descriptions and an alarm mute button in controller
3. 3-phase generator sensing and protection
4. Unbalanced load protection
5. Breaker control via fascia buttons
6. BMS (building management system) integration using MODBUS RTU
7. Standard ISO labeling
8. Multiple language capability
9. Remote start/stop control
10. Local run/off/auto control integral to system microprocessor
11. Cooldown timer
12. Speed adjust
13. Lamp test
14. Emergency stop push button
15. Front panel configuration with PIN protection

D. Digital Monitoring Capability:

The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

1. Engine:
 - a. Engine status
 - b. Engine oil pressure
 - c. Engine oil temperature
 - d. Engine coolant temperature
 - e. Engine crankcase pressure
 - f. Engine boost pressure
 - g. Engine turbo inlet pressure
 - h. Engine Speed (RPM)
 - i. Engine battery voltage
 - j. Engine run time
 - k. Engine fuel level
 - l. Engine crank attempt counter
 - m. Engine successful start counter
 - n. Service maintenance interval
 - o. Real time clock
 - p. Engine exhaust stack temperature
 - q. Engine main bearing temperature

2. Generator:

- a. Generator AC volts (Line to Line, Line to Neutral)
- b. Generator AC current (Avg and Per Phase)
- c. Generator AC Frequency
- d. Generator kW (Total and Per Phase)
- e. Generator kVA (Total and Per Phase)
- f. Generator kVAR (Total and Per Phase)
- g. Power Factor (Avg and Per Phase)
- h. Total kW-hr
- i. Total kVAR-hr
- j. % kW
- k. % kVA
- l. % kVAR
- m. Generator bearing temperature protection
- n. Generator stator winding temperature protection

E. Alarms and shutdowns:

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for multiple past and recent events.

1. Engine Alarm/Shutdown:

- a. Low oil pressure alarm/shutdown
- b. High engine temperature alarm/shutdown
- c. Loss of coolant shutdown
- d. Overspeed shutdown
- e. Over crank shutdown
- f. Emergency stop shutdown
- g. Low coolant temperature alarm
- h. Low battery voltage alarm
- i. High battery voltage alarm
- j. Control switch not in auto position alarm
- k. Battery charger failure alarm

2. Generator Alarm/Shutdown:

- a. Generator phase sequence
- b. Generator over voltage
- c. Generator under voltage
- d. Generator over frequency
- e. Generator under frequency
- f. Generator reverse power (real and reactive)
- g. Generator overcurrent

F. Inputs and Outputs:

1. Programmable Digital & Analog Inputs: The Controller shall include the ability to accept total twelve (12) programmable digital and analog input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts. Additional I/O add-on capability available through expansion modules.
2. Programmable Digital Outputs: The control shall include the ability to operate programmable digital DC output signals, integral to the controller. The DC outputs (2) for fuel and start shall be rated for 10 A resistive for 10 seconds, 5 A resistance continuous at module supply & other configurable DC outputs (6) are 2 A resistive at module supply. Additional I/O add-on capability available through expansion modules.

G. Maintenance:

All engine and control panel shall be accessible through electronic service tool for engine and configuration suit software using Type A to Type B USB data cable for generator. The following maintenance functionality shall be integral to the generator set control.

1. Engine running hours display
2. Service maintenance interval (running hours or calendar days)
3. Engine crank attempt counter
4. Engine successful starts counter
5. Last 250 events are stored in control panel memory
6. Programmable cycle timer that starts and runs the generator for a predetermined time.

H. Remote Communications:

1. Remote Communications: The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates up to 115.2 kbaud rates.
2. Remote Monitoring Software: The control shall provide Monitoring Software with the following functionality:
 - a. Monitor up to 20 expansion modules
 - b. Provide access to all date and events on generator set communications network
 - c. Provide remote control capability for the generator set(s)
 - d. Ability to communicate via Modbus RTU or remote modem

I. Local Indicator and Remote Annunciation:

1. Local indicator: The control shall include following local LED indicators on the control panel:
 - a. A lamp mute & lamp test
 - b. Selection mode
 - c. Manual mode indicator
 - d. Auto mode indicator
 - e. Generator Breaker indicator
 - f. Generator Available indicator

2. Remote annunciators: The controller shall include ability to connect with five (5) remote annunciator modules each consisting of two (2) LED expansion modules. Remote annunciator has functionality of 16 channel fault annunciation when two (2) LED expansion modules are used. It includes an alarm sound that is triggered when host controller detects an alarm condition which can be muted using front push button. The panel will be fitted with removable label cards which can be used to identify the standard NFPA alarms if desired.

J. Telematics and Data Monitoring:

1. Asset Health and Data Monitoring:

- a. There shall be a monitoring and data management system available on a 24/7/365 basis, which interfaces with the asset (generator set, switchgear, etc), via a cellular or Ethernet connection.
- b. It shall provide automated alert notification via text message and/or e-mail. These alerts shall also be displayed by a web-based system (desktop and mobile app) which will be updated automatically.
- c. Asset operating parameters being monitored will be displayed by a web-based system (desktop and mobile app) which will be updated automatically.
- d. Provide remote start/stop operation of generator set and scheduled generator set exercising option.
- e. Asset monitoring allows for remote troubleshooting to diagnose potential issues with the asset in order to upkeep asset health and performance.

2. Analytics and Data Reporting:

- a. The telematics shall provide data analytics for digital insights and status updates through pre-defined KPI reports.
- b. Continual monitoring provides to offer status updates including basic engine / electrical parameters, historical performance and, potential maintenance issues available in every minute to every hour reporting.

3. Telematics and Data Security:

- a. The web-based software shall be secure, requiring a registered user name and password structure for access.
- b. Data Privacy Principles of the remote monitoring system are as follows:
 - 1) The manufacturer shall be transparent about data collection and protecting rights of data owners by implementing privacy policy agreement.
 - 2) The manufacturer shall protect the data collected by following industry standards and certifications for data privacy and data protection.

4. The telematics hardware and remote monitoring user interface shall be an end-to-end system designed with multi-layer security controls and safeguards, to protect against unauthorized access and disclosure.

- a. High level security safeguards include, but not limited to:
 - 1) Cryptographic security controls to protect against unauthorized device software changes.
 - 2) Encrypted and authenticated remote connection.
 - 3) Only an outbound remote connection, initiated by the device, is allowed. Device shall not participate in or responds to general internet traffic.
 - 4) Manufacturer's corporate IT infrastructure secured utilizing generally accepted information security principles and practices.
 - 5) Secure web application connection with user login authentication and role-based access controls.
- b. Security Principles of the remote monitoring system shall be as follows:
 - 1) Dedicated cybersecurity program and team
 - 2) Risk-based approach to multi-layers cybersecurity
 - 3) Proactively about cybersecurity
 - 4) Response and Remediation to Cyber incidence
 - 5) Training and awareness
5. The system will offer the user the option of having alarms and/or events handled by an expert advisor trained by the manufacturer. The advisor shall follow a user-defined procedure for handling alarms and/or events.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
 1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
 2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
 3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
 4. Mounting: Adjacent to, or integrated with, control and monitoring panel.

- C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
 2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H insulation. Windings shall be of the random wound type. Temperature rise shall not exceed 105°C over 40°C ambient temperature.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
 2. Maintain voltage within 15 percent on one step, full load.
 3. Provide anti-hunt provision to stabilize voltage.
 4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

2.09 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Standard neoprene separated by steel shims.

2.10 ENCLOSURE

- A. Attenuated Enclosure:
 - 1. The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on the fuel tank base.
 - a. A weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of 75 dba @ 23 ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.
 - b. Enclosure Sound Attenuation: Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.
 - c. Provide a double wall sub-base tank constructed to meet all local codes and requirements. A fuel tank base of 72 hour capacity shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 100% capacity. The tank shall meet UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer. Provide owner color selection chart.

2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Reference system Commissioning Specifications for additional requirements. Include, at a minimum, the following tests:
1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 2. Full load run.
 3. Maximum power.
 4. Voltage regulation.
 5. Transient and steady-state governing.
 6. Single-step load pickup.
 7. Safety shutdown.
 8. Provide 30 days' advanced notice of tests and for observation of tests by Owner's representative.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Owner no fewer than 45 days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.
- B. Comply with NECA 1 and NECA 404.
- C. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

D. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases.
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Install packaged engine generator with elastomeric isolator pads having a minimum deflection of 1 inch (25 mm) on 12-inch- (300-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases.
4. Remote Radiators:
 - a. Install remote radiator with elastomeric isolator pads on concrete base on grade.

E. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

F. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) of clearance from combustibles.

G. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.

H. Fuel Piping:

1. Copper and galvanized steel shall not be used in the fuel-oil piping system.

I. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

J. Electrical Wiring:

1. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Electrical wiring includes but is not limited to battery chargers, heaters, control power, load bank, grounding, remote annunciator panels, paralleling gear, remote control panels, etc. Contractor to include as part of their scope of work, wall wiring and empty conduit indicated on contract drawings, specified herein, indicated/noted on approved manufacturers shop drawings and as required to provide a fully functional system.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

- C. Connect cooling-system water piping to engine generator and heat exchanger with flexible connectors.
- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Connect fuel piping to engines with a gate valve and union and flexible connector.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.
- H. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.04 IDENTIFICATION

- A. Identify system components according to Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Field Testing: If factory service technicians cannot provide the field testing specified as part of manufacturer's start-up, the contractor shall engage a qualified factory certified and authorized testing agency to perform tests and inspections and prepare test reports required by manufacturer.
- B. Manufacturer's Field Service: Contractor to include field services of factory-authorized service representatives to provide start-up testing as well as to assist in 3rd party system commissioning as specified under the system commissioning specifications. Testing will not be concurrent so multiple travel days shall be included as per the approved schedule.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.
 - a. Visual and Mechanical Inspection:
 - 1) Compare equipment nameplate data with Drawings and the Specifications.
 - 2) Inspect physical and mechanical condition.
 - 3) Inspect anchorage, alignment, and grounding.
 - 4) Verify that the unit is clean.

- b. Electrical and Mechanical Tests:
 - 1) Perform insulation-resistance tests according to IEEE 43.
 - a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.
 - b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
 - 2) Test protective relay devices.
 - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
 - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
 - 5) Perform vibration test for each main bearing cap.
 - 6) Verify correct functioning of the governor and regulator.
- 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
- 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
- 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
- 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
- 7. Exhaust Emissions Test: Comply with applicable government test criteria.

8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 10. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations 25 feet (8 m) from edge of the generator enclosure, and compare measured levels with required values.
- E. Coordinate tests with tests for transfer switches and run them concurrently.
 - F. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - G. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
 - H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
 - I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - J. Remove and replace malfunctioning units and reinspect as specified above.
 - K. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
 - L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 26 3600
TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes automatic transfer switches rated 600 V and less.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
 - 2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.

1.03 INFORMATIONAL SUBMITTALS

- A. Source quality control reports.
- B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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. Comply with NEMA ICS 1.
- C. Comply with NFPA 110.

- D. Comply with UL 1008 unless requirements of these Specifications are stricter.
- E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
 - 2. Short-time withstand capability for 30 cycles.
- G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- J. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Surge Protective Device: Service rated.
 - 6. Ground-Fault Protection: Comply with UL 1008 for normal bus.
 - 7. Service Disconnecting Means: Externally operated, manual electrically actuated.
- K. Neutral Switching: Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- L. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed tape markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.02 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASCO Power Technologies.
 - 2. Caterpillar, Inc.; Electric Power Division.
 - 3. Rehlko.
 - 4. Rolls-Royce Solutions America Inc.
 - 5. Or Engineer approved equal.
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
 - 4. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 5. Material: Hard-drawn copper, 98 percent conductivity.
 - 6. Main and Neutral Lugs: Compression type.
 - 7. Ground Lugs and Bus-Configured Terminators: Compression type.
 - 8. Connectors shall be marked for conductor size and type according to UL 1008.
- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

- E. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
 - 2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
 - 3. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.
- F. Signal-Before-Transfer Contacts: Multiple sets of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- G. Automatic Transfer-Switch Controller Features:
 - 1. Controller operates through a period of loss of control power.
 - 2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is unavailable.

H. Large-Motor-Load Power Transfer:

1. In-Phase Monitor: Factory-wired, internal relay controls transfer so contacts close only when the two sources are synchronized in phase and frequency. Relay shall compare phase relationship and frequency difference between normal and emergency sources and initiate transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer shall be initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
2. Motor Disconnect and Timing Relay Controls: Designated starters in loss of power scenario shall disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters shall be through wiring external to automatic transfer switch. Provide adjustable time delay between 1 and 60 seconds for reconnecting individual motor loads. Provide relay contacts rated for motor-control circuit inrush and for actual seal currents to be encountered.
3. Programmed Neutral Switch Position: Switch operator with programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Adjustable pause from 0.5 to 30 seconds minimum, and factory set for 0.5 second unless otherwise indicated. Time delay occurs for both transfer directions. Disable pause unless both sources are live.

2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
 - 1. For each of the tests required by UL 1008, performed on representative devices, for legally required systems. Include results of test for the following conditions:
 - a. Overvoltage.
 - b. Undervoltage.
 - c. Loss of supply voltage.
 - d. Reduction of supply voltage.
 - e. Alternative supply voltage or frequency is at minimum acceptable values.
 - f. Temperature rise.
 - g. Dielectric voltage-withstand; before and after short-circuit test.
 - h. Overload.
 - i. Contact opening.
 - j. Endurance.
 - k. Short circuit.
 - l. Short-time current capability.
 - m. Receptacle withstand capability.
 - n. Insulating base and supports damage.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Install transfer switches on cast-in-place concrete equipment base(s).
 - 2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 3. Provide workspace and clearances required by NFPA 70.
- B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
- C. Identify components according to Section 260553 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- E. Comply with NECA 1.

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, motor controls, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- F. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches (457 mm) in length.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.
 - d. Verify that the unit is clean.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Verify that manual transfer warnings are attached and visible.
 - g. Verify tightness of all control connections.
 - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - i. Perform manual transfer operation.

- j. Verify positive mechanical interlocking between normal and alternate sources.
 - k. Perform visual and mechanical inspection of surge arresters.
 - l. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
 - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
2. Electrical Tests:
- a. Perform insulation-resistance tests on all control wiring with respect to ground.
 - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
 - c. Verify settings and operation of control devices.
 - d. Calibrate and set all relays and timers.
 - e. Verify phase rotation, phasing, and synchronized operation.
 - f. Perform automatic transfer tests.
 - g. Verify correct operation and timing of the following functions:
 - 1) Normal source voltage-sensing and frequency-sensing relays.
 - 2) Engine start sequence.
 - 3) Time delay on transfer.
 - 4) Alternative source voltage-sensing and frequency-sensing relays.
 - 5) Automatic transfer operation.
 - 6) Interlocks and limit switch function.
 - 7) Time delay and retransfer on normal power restoration.
 - 8) Engine cool-down and shutdown feature.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
- a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.

4. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- B. Coordinate tests with tests of generator and run them concurrently.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- D. Transfer switches will be considered defective if they do not pass tests and inspections.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.
- G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION