PROJECT MANUAL

for the

Camp Niantic
Utility Ductbank Installation

at

Camp Niantic
Smith Street, Niantic, Connecticut

PROJECT NO.

16MIL23803

Prepared By

CONNECTICUT ARMY NATIONAL GUARD
FACILITIES MANAGEMENT OFFICE

360 Broad Street, Hartford, Connecticut

Tracking No. NI-12-02
7-20-16

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Camp Niantic
Utility Ductbank Installation
Smith Street, Niantic, CT

Project No.: 16MIL23803

Prepared By:
CONSTRUCTION AND FACILITY MANAGEMENT OFFICE
360 Broad Street
Hartford, Ct, 06105

Seals & Signatures		Seals & Signatures	
STATE OF CONNECTICUT BENJAMIN J NEUMON 28274 LICENSED PROFESSIONAL ENGINEER	BENJAMIN NEUMON, PE *(Print Consultant Name)*		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*

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CERTIFICATE (of Authority)

I _____ , _____
(Signer's Name) *(Signer's Title)*

of _____ , an entity lawfully organized and existing under the laws
(Name of Entity)

of _____ , do hereby certify that the following is a true and correct
(Name of State or Commonwealth)

copy of a resolution adopted on the _____ day of _____ , 20 _____ by the governing body of
(Day)[1] *(Month)*[1] *(Year)*[1]

_____ , in accordance with all of its documents of governance and
(Name Of Entity)

management and the laws of _____ and further certify that such resolution has not
(Name of State or Commonwealth)

been modified, rescinded or revoked, and is at present in full force and effect.

RESOLVED: that _____ , _____
(Name and Title of Signer of Contract Documents)[2]

of _____ is empowered and authorized, on behalf of the entity,
(name of entity)

to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Military Department, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has executed this certificate this _____ day of _____ , 20 _____ .
(Day)[3] *(Month)*[3] *(Year)*[3]

_____
(Signature)

_____ _____
(Print Name) *(Title)*

1 – This date must be on or before the date of signing of the subject document.
2 – This person shall sign the subject document and other required documents.
3 – This date must be on or after the date of signing of the subject document.

FOR YOUR INFORMATION

Certificate (of Authority)
What the **Certificate** is saying is that the organization authorized the signatory to sign the pertinent **documents other than** the Certificate (of Authority) and that, as of the date of **execution** of the CERTIFICATE (i.e., the date set forth in the "In Witness Whereof" blanks) there has been no change in that authorization.
Instructions for completing the **Certificate** (of Authority)
The **Certificate (Authority)** to Accompany the **Bid Proposal Form:** **1. 1st Paragraph:** **a.** First, enter the name and title of the individual signing the Certificate (of Authority). **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry). **c.** Third, enter the name of the state or commonwealth the entity is registered in. **d.** Fourth, enter the **date** the **resolution** was adopted by the governing body. This **date** is **on** or **before** the date the **Bid Proposal** is signed. **e.** Fifth, enter the name of the state or commonwealth the entity is registered in. **2. 2nd Paragraph:** **a.** First enter the name and title of the individual signing bid documents for the entity. **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry). **3. Last Paragraph:** **a.** Enter the **Witness date.** This date will likely be the date of execution of the **Bid Proposal form**. THE DATE SHOULD **NOT** BE BEFORE THE DATE OF **EXECUTION** OF THE **BID PROPOSAL**.
The **Certificate (Authority)** to Accompany the **Contract:** **4. 1st Paragraph:** **a.** First, enter the name and title of the individual signing the Certificate (of Authority). **b.** Second, enter the legal name the entity (exactly as it is shown on the Secretary of State registry). **c.** Third, enter the name of the state or commonwealth the entity is registered in. **d.** Fourth, enter the **date** the **resolution** was adopted by the governing body. This **date** is **on** or **before** the date the **Contract** is signed. **e.** Fifth, enter the name of the state or commonwealth the entity is registered in. **5. 2nd Paragraph:** **a.** First enter the name and title of the individual signing contract documents for the entity. **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry). **6. Last Paragraph:** **a.** Enter the **Witness date.** This date will likely be the date of execution of the **CONTRACT**. THE DATE SHOULD **NOT** BE BEFORE THE DATE OF **EXECUTION** OF THE **CONTRACT**.

END
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01 10 00 SUMMARY

01 11 00 SUMMARY OF WORK

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

B. **Project Number:** 16MIL23803.

C. **Project Title**: Camp Niantic Infrastructure Improvements.

D. **Project Location:** Camp Niantic, located on Smith Street, Niantic, Connecticut.

E. **The Project Description**

The project includes construction of concrete encased duct bank, including manholes and vaults, for electrical service and all necessary restoration of pavement and grassed areas. Installation of transformers and re-feeding of several small buildings to enable removal of existing overhead electrical lines. Installation of street lighting.

01 11 13 WORK COVERED BY CONTRACT DOCUMENTS

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

B. The Work includes but is not limited to the following:

1. Construction of concrete-encased ductbank, including manholes and vaults, for electrical service and all necessary restoration of pavement and grassed areas. Installation of transformers and re-feeding of several small buildings to enable removal of existing overhead electrical lines. Installation of street lighting.
2. The Contractor will include in his bid, all items required in order to carry out the intent of the work as described, shown and implied in the Contract Documents.
3. Contract drawings include work for two Supplemental Bids to be included separately in the Contractor’s pricing.

C. It shall be the Contractor's responsibility upon discovery to immediately notify the Construction Administrator, in writing, of errors, omissions, discrepancies, and instances of noncompliance with applicable codes and regulations within the documents, and of any work which will not fit or properly function if installed as indicated on the Contract Documents. Any additional costs arising from the Contractor's failure to provide such notification shall be borne by the Contractor.

E. The Work will be constructed under a single lump sum contract with two supplemental bids.

F. **Examination of Site:**

1. It is not the intent of the Documents to show all existing conditions. All contractors are advised to visit and examine the site with the Construction Administrator prior to submitting bids.

2. Contractors should investigate and satisfy themselves as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, to uncertainties of weather, roads or similar physical conditions of the ground, the character of equipment, and facilities needed preliminary to and during the prosecution of the Work. The Contractor should further satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the Contract Documents. Any failure by the Contractor to acquaint himself with the available information shall not relieve him from the responsibility for estimating properly the difficulty and cost of successfully performing the Work.

3. **Pre-Bid Conference:**

4.1 A Pre-Bid Conference and tour of the site will be conducted as scheduled in the Invitation to Bid. This scheduled conference is the only official opportunity for the bidders to tour the site.

G. **Project Documents:**

1. The Specifications and Drawings are intended to describe and illustrate the materials and labor necessary for the work of this Project.

2. Throughout the Technical Specifications, the Connecticut Department of Transportation Standard Specifications for Roads, Bridges, and Incidental Construction Form 814A, current addition including any interim and supplemental specifications are referenced. Where so referenced the requirements set forth therein are applicable and made a part hereof Copies of Form 814A are available from the Connecticut Department of Transportation at a nominal charge.

H. The General Contractor will be given two sets of the Contract Documents on or about the time of execution of Contract, free of charge. If additional copies are wanted, they will be available at the direct additional cost of their reproduction, to the contractor.

I. The Contractor shall receive one (1) set of AutoCAD compatible (latest version) plans on disks at no cost on or about the time of execution of the Contract from the Architect. Additional sets of AutoCAD compatible (latest version) Plans on disks from the Architect at the cost of their reproduction, to the contractor.

01 12 16 WORK SEQUENCE

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

B. The entire Project shall be constructed in One (1) Phase. Work of this Phase shall be substantially complete within 210 Calendar Days of commencement of the Work (the “Contract Time”).

C. Each Task may be phases within the contract period to work around weather conditions and must minimize impact to training operations and activities at Camp Niantic.

01 12 19 CONTRACT INTERFACE

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

B. **Owner:** The Owner is the Military Department, State of Connecticut.

1. The authorized representative for the Owner is Marie Thompson. The Project Manager is located at 360 Broad Street, Hartford, CT. Phone; 860-524-4995; Email: marie.thompson@ct.gov.

2. The authorized representative for the Military Department, is empowered to act in matters involving revoking, altering, enlarging or relaxing any requirement of the contract documents.

C. **Agency:** The Agency is the Military Department.

1. The Agency Representative is Elizabeth Tracey. The Agency Representative is located at 360 Broad Street, Hartford, Connecticut. Phone: 860-548-3202; Email: elizabeth.s.tracey2.nfg@mail.mil.

2. The Agency Representative has the administrative authority for the facility and or site where the work is being performed but does not have the authority to change the contract documents or direct the contractor.

D. **Architect and Engineer:** The Engineer is Major Benjamin Neumon. The Engineer is located at 360 Broad Street, Hartford, Connecticut. Phone: 860-524-4936; Email: benjamin.j.neumon.mil@mail.mil.

1. The Architect and Engineer or their accredited representative is referred to in the Contract Documents as "Architect" or "Architects" or "Engineer" or "Engineers" or by pronouns which imply them. As information for the Contractor, the Architect’s or Engineer's status is defined as follows:

1.1 The Architect and Engineer will not make interpretations or decisions directly to the Contractor. All interpretations or decisions will be conveyed through the Construction Administrator.

1.2 As the authorized representative of the Military Department, the Architect and Engineer is responsible for review of shop drawings, materials, and equipment intended for the work, in accordance with the "General Conditions", and the "Supplementary Conditions".

1.3 Wherever the Architect or Engineer is mentioned in the documents in connection with an administrative function, it shall include the Construction Administrator in that function except for shop drawings.

E. **Construction Administrator:** The Construction Administrator is James Cavanna, 360 Broad Street, Hartford, 06105. Phone: 860-548-3279; Email: James.a.cavanna.nfg@mail.mil.

1. The Construction Administrator is referred to in the Contract Documents as "Construction Administrator" or "Construction Manager" or by pronouns which imply it. All communications concerning the project will be directed through the Construction Administrator or a designated representative(s).

2. As information to the Contractor, the Construction Administrator's status is defined as follows:

2.1 The Construction Administrator is the Owner's Agent who will, among other thing's, monitor the General Contractor's performance, scheduling and construction, process shop drawings, material, and equipment submittals, review and process periodic billings, review and recommend cost changes.

2.2 The Construction Administrator will process all requests for information, interpretations and decisions regarding the meaning and intent of the Contract Documents, consulting with appropriate parties prior to rendering the interpretations or decisions to the Contractor. All such requests and replies shall be in writing.

F. **PMWeb Project Management:**

NOT USED

01 14 00 WORK RESTRICTIONS

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

B. The Contractor shall confine his operations, including storage of apparatus, equipment and materials to the contract limit lines as directed by the Construction Administrator.

C. The areas and/or spaces, including their access, shall be maintained free and clear throughout the contract term.

D. Parking for Contractor's employees will be limited to an area (or areas) designated by the Construction Administrator. The Contractor may be required to provide identification stickers for employees' cars.

01 14 16 COORDINATION WITH OCCUPANTS

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

B. **Full Agency Occupancy During Construction:** The Agency will occupy the site and existing buildings during the entire construction period. Cooperate with the Agency during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Agency's operations.

1. Provide adequate building and fire code egress from the buildings during the renovation process. The Contractor will be responsible to maintain and protect egress ways during the construction sequence per the design as supplied by the Architect. Contractor shall be responsible for preparing egress plans for Owner approval and for Office of State Building Official and Office of State Fire Marshal for approval if required.

C. **Partial Agency Occupancy:** The Agency reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Should it become necessary or advisable, as the work nears final completion, for the Agency to occupy a portion of the building prior to final acceptance, the Contractor shall cooperate in completing such areas and making same accessible.

2. The Construction Administrator will determine whether such occupancy or use is possible and, if so, will make arrangements for holding a job inspection with the Project Manager, Agency Representative, Architect and General Contractor.

3. A comprehensive list of items to be completed or corrected as issued by the General Contractor, together with the status of completion and terms of occupancy, will be forwarded to the Project Manager and the Architect by the Construction Administrator. A letter will be issued by the Project Manager and Architect to Construction Administrator granting such occupancy and will state the terms and conditions of occupancy.

4. Prior to partial Agency occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Agency will operate and maintain mechanical and electrical systems serving occupied portions of the building.

5. The Architect will prepare a “Certificate of Substantial Completion” for each specific portion of the Work to be occupied prior to Agency occupancy. Use the “Certificate of Substantial Completion” form as required by the Owner.

6. The Project Manager will request a signed “Certificate of Compliance” from Commissioner of the Military Department, Architect, and Contractor, if required.

6. The Project Manager will request a signed “Certificate of Compliance” from the , Architect, and Contractor, and forward the Certificate to the Office of State Building Inspector for a Certificate of Occupancy and obtain the same after his review and approval.

7. A letter from the Project Manager to the Agency Representative with copy to the General Contractor granting occupancy will state the terms and conditions of occupancy and that fire insurance coverage has been requested, the effective date of which will indicate to the Contractor that he may cancel fire insurance coverage for that portion of the project.

8. Upon occupancy, the Agency will assume responsibility for maintenance and custodial service for occupied portions of the building.

9. **Work after Partial Agency Occupancy:**

9.1 For all work to complete the area occupied, warranty work, the balancing and commissioning of systems, repair of latent defects and adjustments after partial occupancy, the contractor is responsible for all costs associated with working in occupied buildings.

D. **Agency Occupancy:**

1. The Construction Administrator will determine whether such occupancy is possible and, if so, will make arrangements for holding a job inspection with the Project Manager, Agency Representative, Architect and General Contractor.

2. A comprehensive list of items to be completed or corrected as issued by the General Contractor, together with the status of completion and terms of occupancy, will be forwarded to the Project Manager and the Architect by the Construction Administrator. A letter will be issued by the Project Manager and Architect to Construction Administrator granting such occupancy and will state the terms and conditions of occupancy.

3. Prior to Agency occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Agency will operate and maintain mechanical and electrical systems serving occupied portions of the building.

4. The Architect will prepare a **"**Certificate of Substantial Completion" for the Work to be occupied prior to Agency occupancy. Use the "Certificate of Substantial Completion" form as required by the Owner.

5. The Project Manager will request a signed "Certificate of Compliance" from Commissioner of the Military Department, Architect, and Contractor, if required.

5. The Project Manager will request a signed "Certificate of Compliance" from the Architect, and Contractor, and forward the Certificate to the State Building Inspector a Certificate of Occupancy and obtain the same after his review and approval.

6. A letter from the Project Manager to the Agency Representative with copy to the General Contractor granting occupancy will state the terms and conditions of occupancy and that fire insurance coverage has been requested, the effective date of which will indicate to the Contractor that he may cancel fire insurance coverage for the project.

7. Upon occupancy, the Agency will assume responsibility for maintenance and custodial service for occupied portions of the building.

8. Work after Agency Occupancy:

8.1 For all work to complete the occupied building, warranty work, the balancing and commissioning of systems, repair of latent defects and adjustments after occupancy, the contractor is responsible for all costs associated with working in occupied buildings.

01 14 23 SUBCONTRACTOR EVALUATIONS:

A. Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). The General Contractor shall complete and submit to the State of Connecticut Military Department evaluations of each such subcontractor upon fifty percent (50%) completion of the project and upon Substantial Completion of the project. The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute, result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to CT CDS in accordance with this provision.

End
Section 01 10 00
Summary of Work

01 20 00 CONTRACT CONSIDERATIONS

01 21 00 ALLOWANCES

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

B. The Contractor's costs for unloading and handling, labor, installation costs, storage, insurance, overhead and profit and other expense related to the Allowance item shall be included in the Lump Sum Bid Amount and not in the Allowance unless stated otherwise is the Allowance Schedule of this section.

C. **Architect/Engineer:**

1. Consult with Contractor for consideration of Products, suppliers and installers.

2. Select Products in consultation with the Project Manager and Agency Representatives and transmit decision to Construction Administrator.

3. Prepare Change Order.

D. **Construction Administrator Responsibilities:**

1. Consult with Architect/Engineer, Contractor, Project Manager and Agency Representatives for consideration of Products, suppliers and installers.

2. Select Products in consultation with Architect/Engineer, Project Manager and Agency Representatives and transmit decision to Contractor

3. Prepare Change Order.

E. **General Contractor Responsibilities:**

1. Assist Architect/Engineer and Construction Administrator in selection of Products and Suppliers.

2. Obtain proposals from Suppliers and offer recommendations.

3. On notification of selection by Construction Administrator execute purchase agreement with designated supplier.

4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.

5. If the actual cost of an Allowance item is more or less than the given amount, the Contract Sum will be adjusted by Change Order.

F. **Allowance Schedule:**

1. Allowance No. 1: Electrical Engineering Services: Contractor's bid and the Contract for Construction to reflect an allowance of $25,000 for Electrical Engineering services to review submittals and certify the final design of the utility service wiring, conduits, and installation meets current State codes and the use of the site as indicated in the bid documents.

01 22 00 UNIT PRICES - GENERAL

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

B. **Definition - Unit Price:** Amount the General Contractor acknowledges in the Bid Proposal Form as a price per unit of measurement for materials or services as described in the Bidding Documents or in the Contract Documents.

C. **Procedures:**

1. Unit Prices included in the Contract Documents are to be used for determining compensation to the Contractor or Owner for changes to the scope of the work indicated in the Contract Documents, and included in the Lump Sum Contract Price. Special Unit Prices are for items complete, in place, and shall be inclusive of furnishing and installing of all material, labor, trucking, overhead, profit, equipment, hoisting, engineering, scaffolding, power hookups, protection, shop drawings, taxes, permits, appliances, delivery, insurance, supervision, cost of bond, etc. and shall remain in effect until completion of the Contract.

2. **Unit Price:** Is identified by the Owner as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

3. **Increases or Decreases:** Should the amount of the Work required be increased or decreased because of changes in the work ordered in writing by the Project Manager, the Undersigned agrees that the following supplemental UNIT PRICES will be decreased 10% for a reduction of work. Each Unit Price shall include all equipment, tools, labor, permits, fees, etc., incidental to the completion of the work involved. All items marked with an asterisk (*****) in the unit price schedules shall include the completion of the excavation, formation and compaction of sub-grade and the disposal of surplus or unsuitable materials in accordance with the Plans and Specifications or as directed by the Construction Administrator.

D. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

E. **Defect Assessment:** Replace the Work, or portions of the Work, not conforming to the specified requirements. If, in the opinion of the Architect/Engineer it is not practical to remove and replace the work the Architect/Engineer will direct an appropriate remedy or adjust the payment.

F. **Unit Price Schedule:** A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

01 22 19 UNIT PRICE SCHEDULE

NOT USED

01 23 00 SUPPLEMENTAL BIDS

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

B. **Definitions**

1. Supplemental Bid: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents

   1.1. Supplemental Bids described in this section are part of the Work only if enumerated in the Agreement.

   1.2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

C. **Procedures**

1. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into project.

1.1. Include as part of each supplemental bid, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of supplemental bid.

2. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each supplemental bid. Indicate if supplemental bids have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to supplemental bids.

3. Execute accepted supplemental bids under the same conditions as other work of the Contract.

4. Schedule: A schedule of supplemental bids is included at the end of this section. Specification sections referenced in schedule contain requirements for materials necessary to achieve the work described under each supplemental bid.

D. Schedule of Supplemental Bids

1. **Supplemental Bid 1: Site Lighting**: Make all materials and labor associated with the site lighting fixtures, poles and wiring a supplemental bid.

2. **Supplemental Bid 2: Northern Ductbank Extension**: Make all work associated with the electrical ductbank installation exiting manhole south of Building 806, running east to manhole no. 4, then north to manhole no. 5, then east to manhole no. 9 at the corner of 3rd Street and Perimeter Road a supplemental bid.

3. **Supplemental Bid 3: Ductbank Loop Extension**: Make all work associated with the electrical ductbank installation exiting manhole no. 7, east of Building 803, running south to manhole no. 11, then east to manhole no. 13, then north to existing manhole no. 9 at the corner of 3rd Street and Perimeter Road a supplemental bid.

01 25 00 SUBSTITUTION PROCEDURES

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

B. Summary

1. This Section includes administrative and procedural requirements for handling requests for equals and substitutions made after award of the Contract.

2. Related Sections: The following Sections contain requirements that relate to this Section:

2.1 Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

2.2 Division 01 Section 01 42 19 "Reference Standards" specifies the applicability of industry standards to products specified.

2.3 Division 01 Section 01 60 00 "Product Requirements" specifies requirements governing the Contractor's selection of products and product options.

C. Definitions

1. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

2. **Equals or Substitutions General:** Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract.

D. Submittals

1. **Equals and Substitution Request Submittals:** The Owner will consider requests for equals or substitutions if made prior to the Receipt of the Competitive Bid. The information on all materials shall be consistent with the information herein. After the contract award, substitutions will be considered for materials or systems specified that are no longer available. It will not be considered if the product was not purchased in a reasonable time after award. The Contractor shall submit all equal and substitutions requests on the ***"Equal or Substitute Product Request"*** Form, an example is shown at the end of this Section and the Form is available from the Construction Representative (CA). See Article 15 in the General Conditions for further refinement and information.

   1.1 The Contractor is required to prepare and submit three (3) copies of the required data for the first manufacturer listed or procedure listed in the specifications section with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the required data for the proposed Equal or Substitution. This will enable the Owner and Architect to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

3. Provide complete documentation showing compliance with the requirements for equals or substitutions, and the following information, as appropriate:

   3.1 Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed Equal or Substitution.

   3.2 A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

   3.3 Product Data, including Shop Drawings and descriptions of products and fabrication and installation procedures.

   3.4 Samples, where applicable or requested.

   3.5 A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.

   3.6 Cost information, broken down, including a proposal of the net change, if any in the Contract Sum.

   3.7 The Contractor's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

   2.8 The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.

4. **Architect's Action:** If necessary, the Architect will request additional information or documentation for evaluation within **seven (7)** Calendar Days of receipt of the original request for equal or substitution request. The Architect will notify the Construction Administrator who will notify the Owner of recommended acceptance

or rejection of the proposed equal or substitution, within **fourteen (14)** Calendar Days of receipt of the request, or **seven (7)** Calendar Days of receipt of additional information or documentation, whichever is later. The Construction Administrator will give final acceptance or rejection by the Owner not less than **seven (7)** Calendar Days after notification.

1.1 Any request deemed an "Equal" and accepted by the Construction Administrator, Architect, Owner, and Agency will result in written notification to the Contractor and will not be in the form of a change order for an "Equal".

1.2 Any request deemed a "Substitution" and rejected or approved by Construction Administrator, Architect, and Owner may result in written notification to the Contractor and may be in the form of a Change Order if the "Substitution" is approved.

E. Equal Or Substitutions

5. Conditions: The Architect will consider the Contractor's request for Equal or Substitution of a product or method of construction when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests to the Construction Administrator without action except to record noncompliance with these requirements.

1.1 The proposed request is in accordance with the general intent of the Contract Documents.
1.2 The proposed request is timely, fully documented, and/or properly submitted.
1.3 The proposed request can be provided within the Contract Time. However, the Architect will not consider the proposed request if it is a result of the Contractor's failure to pursue the Work promptly or coordinate activities properly.
1.4 The proposed request will offer the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. However, if the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution.
1.5 The proposed request can receive the necessary approvals, in a timely manner, required by governing authorities having jurisdiction.
1.6 The proposed request can be provided in a manner that is compatible with the Work as certified by the Contractor.
1.7 The proposed request can be coordinated with the Work as certified by the Contractor.
1.8 The proposed request can uphold the warranties required by the Contract Documents as certified by the Contractor.

1. The Contractor's submission and the Architect's review of Submittals, including but not limited to, Samples, Manufacturer's Data, Shop Drawings, or other such items, which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.

2. Equal or Substitution Produce Request Form (Example)**:**

Connecticut
Department of Construction Services

7001
Equal or Substitute Product Request

Page 1 of 1

Request Phase Pre-Bid ☐ Post Bid ☐ *(See Article 15 Materials: Standards, General Conditions)*

(If Pre-bid only) Current Bid Due Date: _____ **Request No.:** _____ **Dated:** _____

To: State of Connecticut
Department of Construction Services

CTDCS Project No.: _____
Project Name / Location:

References: Specification(s): Section(s): _____ Paragraph(s): _____
Drawing(s): Drawing(s) No(s): _____ Detail(s) No(s): _____

Contractually Specified Product: _____
Contractor Proposed Product: _____

Proposed Product is : Equal: ☐ Substitute: ☐ Model No.: _____

*See attached data for **both** specified and proposed products as required by Article 15 General Conditions.*

Data attached: Drawings: ☐ Product Data: ☐ Reports: ☐ Samples: ☐
Tests: ☐ Other: _____

Reason(s) for not providing the Specified Product:

Similar Installation:
Project: Architect:
Address: Owner:
Date Installed:

Will proposed substitution impact other parts of the Work? No ☐ Yes ☐ *If yes attach explanation.*
Will proposed substitution increase Contract Time? No ☐ Yes ☐ *by number of Days* _____

Actual Dollar Savings to the State of Connecticut if substitution is accepted: $ _____

The Undersigned Certifies that the proposed Request for an Equal or Substitute Product conforms to all of the requirements of Division 01 General Requirements, Section 01 25 00 Substitution Procedures .

Request Submitted By General Contractor / CMR: _____
(Firm's Typed Name)

By: _____ *(Typed Name)* _____ *(Title)* _____ *(Signature)* _____ *(Date)*

CONTRACTOR / CMR Send copies to DCS PM: ☐ CA /OR: ☐

Consultant's Review – This Substitution Request is: Request Received on (Date): _____

☐ **Approved:** *(Submittals in accordance with Div. 01 General Requirements, Section 01 33 00 Submittal Procedures.)*
☐ **Approved as Noted:** *(Submittals in accordance with Div. 01 General Requirements, Section 01 33 00 Submittal Procedures.)*
☐ **Rejected:** **Use Specified Materials.**
☐ **Rejected:** **Request Not Received Within Specified Time Period - Use Specified Materials.**

Reviewed Issued By: _____ *(Typed Name)* _____ *(Signature)* _____ *(Date)*

CONSULTANT Send copies to: DCS PM: ☐ CA /OR: ☐ Chief Architect ☐ Chief Engineer ☐

If Approved: As noted by Consultant,
DCS Director of Project Management: _____ *(Signature)* _____ *(Date)*

Copies: Project File Red R2

CT DCS – 7001 (Rev: 02.12.12) **7000 – Construction Phase Forms**

01 26 00 CONTRACT MODIFICATION PROCEDURES

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

B. **Summary**

1. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after award of the Contract.
2. Division 01 Section 01 29 76 "Progress Payment Procedures" for administrative procedures governing Applications for Payment.
3. Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.
4. Division 01 Section 01 33 00 "Submittal Procedures" for requirements for submittal of the Construction Progress Schedule.
5. Division 00 General Requirements “Article 13” “Change Orders”.

D. **Requests For Information**

1. In the event that the Contractor or subcontractor, at any tier, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Architect, the Contractor shall submit a "Request for Information" in writing to the Architect via the Construction Administrator. "Requests for Information" may only be submitted by the Contractor and shall only be submitted on the "Request for Information" forms as required by the Owner.

1.1 In the "Request for Information", the Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Architect.

1.2 In the "Request for Information", the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

1.3 The Owner acknowledges that this is a complex project. Based upon the owner’s past experience with projects of similar complexity, the Owner anticipates that there will probably be some "Requests for Information" on this project.

1.4 The Architect will review all "Requests for Information" to determine whether they are valid "Requests for Information". If it is determined that the document is not a valid "Request for Information", it will be returned to the Contractor, unreviewed as to content, for resubmittal on the proper form and in the proper manner.

1.5 A "Requests for Information Response" shall be issued within **seven (7)** Calendar Days of receipt of the request from the Contractor unless the Owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within **seven (7)** Calendar Days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a "Request for Information" on an activity with **seven (7)** Calendar Days or less of float on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Architect to respond to the request provided that the Architect responds within the **seven (7)** Calendar Days set forth above.

1.6 A "Request for Information Response" from Architect will not change any requirement of the Contract Documents. In the event the Contractor believes that the "Request for Information Response" will cause a change to the requirements of the Contract Documents, the Contractor shall within **seven (7)** Calendar Days give written notice to the Construction Administrator stating that the Contractor believes the "Request for Information Response" will result in a "Change Order" and the Contractor intends to submit a "Change Order Proposal" request. Failure to give such written notice **seven (7)** Calendar Days shall waive the Contractor's right to seek additional time or cost under the requirement these Requirements.

E. Minor Changes In The Work

1. The Architect, through the Construction Administrator, will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on the "Supplemental Instructions" form as required by the Owner.

F. Proposal Request

1. Architect/Owner-Initiated Requests For Proposals: The Architect or Owner will issue a detailed description of proposed changes in the Work via the Construction Administrator that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Such requests shall be on a "Proposal Request" form as required by the Owner.

1.1 "Proposal Request" is issued for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

1.1.1 Within **fourteen (14)** Calendar Days of receipt of a "Proposal Request", submit a "Change Order Proposal" with the required information necessary to execute the change to the Construction Administrator for the Architect's/Owner's review.

1.1.2 Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

1.1.3 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

1.1.4 Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

1.1.5 The Agency is tax exempt. All Contractor and Subcontractor services provided under your Contract with the State of Connecticut may not be exempt from taxes. The Department of Revenue Services can guide you as to which services are exempt and which are not. Please contact the State of Connecticut, Department of Revenue Services at 1-800-382-9463 or 860-541-3280.

1.1.6 Dollar values shown on the Schedule of Values shall not be the governing (or deciding) final amounts for change orders involving either additional charges or deletions.

G. Change Order Proposal:

1**.** When either a "Request for Information" from the Contractor or a "Proposal Request" from the Architect or Owner results in conditions that may require modifications to the Contract, the Contractor may propose changes by submitting a request for a "Change Order Proposal" to the Architect via the Construction

Administrator on forms as required by the Owner. These forms shall also include "Change Order Proposal Worksheets" as required by the Owner.

1.1 Include statements outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

1.2 Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities as directed by Article 13 of the General Conditions of the Contract for Construction.

1.3 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

1.4 Comply with requirements in Division 01 Section 01 25 00 "Substitution Procedures" if the proposed change requires an equal or substitution of one product or system for a product or system specified.

1.5 The State of Connecticut construction contract has the following tax exemptions:

1.5.1 Purchasing of materials which will be physically incorporated and become a permanent part of the project.

1.5.2 Tools, supplies and equipment used in fulfilling the construction contract are not exempt.

1.5.3 Services that are resold by the contractor are exempt, i.e. if a General Contractor hires a plumber, carpenter or electrician, a resale certificate may be issued to the subcontractor because these services are considered to be integral and inseparable component parts of the building contract.

2. **"Change Order Request" Forms:** Use "Change Order Proposal" and "Change Order Proposal Worksheets" forms as required by Owner.

3. A "Change Order Proposal" cannot be submitted without either prior submission of a "Request for Information" from the Contractor or as a response to a "Proposal Request" submitted by the Architect or Owner.

4. Any "Change Order Request" submitted without a prior submittal of a "Request for Information" or as a response to a "Proposal Request" will be immediately rejected and returned to the Contractor.

H. Construction Change Directive:

1. **"Construction Change Directive":** When the Owner and the Contractor disagree on the terms of a "Change Order Proposal" resulting from either a "Request for Information" or "Proposal Request", then the Architect through the Construction Administrator may issue a "Construction Change Directive" on a "Construction Change Directive" form as authorized by the Owner. The "Construction Change Directive" instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a "Change Order".

1.1 The "Construction Change Directive" contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

1.2 Contractor must proceed with the Work once a "Construction Change Directive" is issued.

1.3 The change in the Contract Sum and Contract Time resulting from the issuance of a "Construction Change Directive" will be based on "Time & Material" or "Unit Prices".

1.4 Issuance of "Construction Change Directive" does not guarantee payment for the Work described in the "Construction Change Directive".

2. **Documentation:** The Contractor shall maintain detailed records on a time and material basis of work required by the "Construction Change Directive".

2.1 After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

2.2 The final value shall be negotiated based on the supporting data to determine the value of the work.

3. **Change Order Procedures:**

3.1 Upon the Owner's approval of a Contractor's "Change Order Proposal", the Construction Administrator will issue a "Change Order" for signatures of the Architect, Owner and the Contractor on a "Change Order" form as required by the Owner.

01 29 76 PROGRESS PAYMENT PROCEDURES

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

B. **Summary:**

1. This Section specifies procedures for preparation and submittal of the Contractor's Applications for Payment.

2. **Related Sections:** The following Sections contain requirements that relate to this Section.

2.1 **Division 00 Notice to Bidders:** Article 10.

2.2 **General Conditions:** Articles: 27 "Schedule of Values, Application for Payment"; 28 "Partial Payments"; 31 "Final Payment"; and 32 "Owner's Right to Withhold Payments".

2.3 Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.

2.4 Division 01 Section 01 33 00 "Submittal Procedures".

2.5 Division 01 Section 01 77 00 "Closeout Procedures" for requirements for Final Payment.

C. **Schedule of Values:**

1. **Coordination:** Coordinate preparation of the "Schedule of Values" with preparation of the Construction Schedule. Use "Schedule of Values" form as required by the Owner.

1.1 Submit the "Schedule of Values" to the Construction Administrator at the earliest possible date but no later than **twenty-one (21)** Calendar Days after Contract Start Date.

1.2 **Sub-schedules:** Where Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

2. **Format and Content:** Use the Project Manual Table of Contents as a guide to establish the format for the "Schedule of Values". Provide at least one line item for each Specification Section on electronic media printout. Each Task (A, B, C & D) must be broken out and cost accounted separately. General Condition costs must be allocated as appropriate to each separate task.

2.1 Identification: Project identification on the Schedule of Values shall include, but not be limited to, the following:

2.1.1 Owner;

2.1.2 Project Number;

2.1.3 Project Name;

2.1.4 Project Location;

2.1.5. Contractor's name and address.

2.2 Arrange the "Schedule of Values" in tabular format as required by the Owner, containing separate columns including, but not limited to, the following Items:

2.2.1 Item Number;

2.2.2. Description of Work with Related Specification Section or Division Number;

2.2.3. Scheduled Values broken down by description number, type material, units of each material.

.1 Include break down of General Condition requirements, i.e. bonds, insurance premiums, taxes, job mobilization, temporary facilities, field supervision and layout, operation and maintenance manuals, punch list activities, project record documents, demonstration and training, overhead, and profit as separate line items.

2.2.4. Name of subcontractor;

2.2.5 Name of manufacturer or fabricator;

2.2.6 Name of supplier;

2.2.7 Retainage;

2.2.8 Contract sum in sufficient detail.

3. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Break principal subcontract amounts down into several line items. In addition, the following items listed below must be included.

4.1 Project Coordination (01 31 13) a lump sum of this cost for payment at the submittal of this product a minimum cost of 1/10th of one percent of the base bid total project cost or $5,000 whichever is greater.

4.3 Photographic Documentation (01 32 33) a monthly cost of $1,000 per month to be paid each month upon receipt of the photographs or forfeit of that month's payment.

4.4 Submittal Schedule (01 33 00) a lump sum payment calculated at 1/20th of 1% of the base bid total project cost upon receipt of the schedule.

4.5 As-Built Updates (01 31 00) a monthly cost, a minimum payment of $1,000 with forfeit of that monthly payment if not done.

4.7 Progress Cleaning (01 74 13) a monthly cost. A minimum payment of $1,000 to $3,000 (based on size & complexity of the project) with forfeit of that monthly payment if not done.

4.8 Start-up and Adjusting (01 75 00) a lump sum cost upon completion. (to be determined by PM with A/E & CA/CM advice).

4.9 Schedule (01 32 16) For the Base Schedule a lump sum payment or 40% of the total schedule budget, with the remainder paid on an even payment over the duration of the project.

5. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

6. **Unit-Cost Allowances:** Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

7. **General Conditions:** Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

7.1 Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

D. **Applications For Payment:**

1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and Construction Administrator and paid for by the Owner.

1.1 The initial "Application for Payment", the "Application for Payment" at time of "Substantial Completion", and the final "Application for Payment", involve additional requirements.

2. **Payment-Application Terms:** The Owner will process monthly progress payments. The Contractor may submit applications for payment on a monthly basis.

3. **Payment-Application Forms:** Use the "Application for Payment" form as required by the Owner. Present the required information on electronic media printout or Owner approved form; multiple pages should be used if required.

3.1 For each item, provide a column including but not limited to the following items:

3.2 Item Number.

3.4 Description of Work and Related Specification Section or Division.

3.5 Scheduled Value, break down by units of material and units of labor.

3.6 Work Completed from previous application.

3.7 Work Completed this period.

3.7.1 Materials presently stored.

3.7.2 Total Completed and stored to date of application.

3.7.3 Percentage of Completion.

3.7.4 Balance to Finish.

3.7.5 Retainage.

E. **Application Preparation:** Complete every entry on the Application form. At the time of Final Payment only, include an executed Application form by a person authorized to sign legal documents on behalf of the Contractor. The Construction Administrator will return incomplete Applications without action.

1. Entries shall match data on the "Schedule of Values".

2. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.

F. **Transmittal:** Except for final payment, submit to the Construction Administrator by a method ensuring receipt within forty-eight (48) hours. One (1) complete, signed and notarized original of each Application for Payment, including lien waivers and similar attachments when required, along with six (6) copies. For Final Payment, nine (9) complete, signed and notarized copies shall be submitted.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

G. **Applications for Payment:** Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment and all subsequent Application for Payments including, but not limited to, the following items:

1. **Subcontractor Evaluations:**
Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). The General Contractor shall complete and submit to the State of Connecticut Department of Construction Services (CT DCS) evaluations of each such subcontractor **upon fifty percent (50%) completion of the project and upon Substantial Completion of the project**. The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute; result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to CT DCS in accordance with this provision.

2. List of subcontractors and suppliers' name, FEIN/Social Security numbers, and Connecticut Tax Registration Numbers;

3. List of principal suppliers and fabricators;

4. Schedule of Values;

5. Contractor's Construction Schedule (preliminary if not final);

6. Schedule of principal products;

7. Submittal Schedule (preliminary if not final);

8. List of Contractor's staff assignments;

9. List of Contractor's principal consultants;

10. Copies of all applicable permits;

11. Copies of authorizations and licenses from governing authorities for performance of the Work;

12. Proof that subcontractors have been paid amounts included on the Contractor's Application for Payment within thirty (30) days after the Owner has paid the Contractor for the particular Application for Payment in accordance with Connecticut General Statute § 49-41a (a)(1).

13. Releases of Lien from subcontractors with amounts included on the Contractor's Application for Payment when Contractor has been paid by the Owner for the particular Application for Payment but the subcontractors have not been paid.

14. Proof that as-built documents are updated as required by Section 01 77 00 "Closeout Procedures."

15. Initial as-built survey and damage report, if required.

15. Update the "Contractor's Master Subcontract Agreement List" and submit copies all recently executed Subcontract Agreements in accordance with CGS § 4b-96.

15.1 The "Contractor's Master Subcontract Agreement List" shall list all Subcontract Agreements in order of Contract Sum magnitude (from high to low) in the following format:

Contractor's Master Subcontract Agreement List				
Subcontractor Name	**Minority Or Small Business Designation**	**Trade**	**Address**	**Contract Sum**

16. In accordance with 42-158j (b):
Each payment requisition submitted shall include a statement showing the status of all pending construction change orders, other pending change directives and approved changes to the original contract or subcontract. Such statement shall identify the pending construction change orders and other pending change directives, and shall include the date such change orders and directives were initiated, the costs associated with their performance and a description of any work completed. As used in this section, "pending construction change order" or "other pending change directive" **means an authorized directive for extra work that has been issued to a contractor or a subcontractor and identified by an official Change Order Number or Construction Change Directive Number assigned by the State of Connecticut**.

H. **Application for Payment at Substantial Completion:** Following issuance of the Certificate of Substantial Completion submit an Application for Payment form; use the form as required by the Owner. Present the required information on electronic media printout as applicable that include, but are not limited, to the following:

1. **Subcontractor Evaluations:**
Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). **The General Contractor shall complete and submit to the State of Connecticut Department of Construction Services (CT DCS) evaluations of each such subcontractor upon fifty percent (50%) completion of the project and upon Substantial Completion of the project.** The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute; result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to CT DCS in accordance with this provision.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

3. Administrative actions and submittals that shall precede or coincide with this application include, but are not limited to, the following:

3.1 Occupancy permits and similar approvals;

3.2 Warranties (guarantees) and maintenance agreements;

33 Test/adjust/balance records;

3.4 Maintenance instructions;

3.5 Meter readings;

3.6 Startup performance reports;

2.7 Changeover information related to Owner's occupancy, use, operation, and maintenance;

3.8 Final cleaning;

3.9 Application for reduction of retainage and consent of surety;

3.10 Advice on shifting insurance coverage;

3.11 Final progress photographs;

3.12 List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

I. **Final Payment Application:** Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include, but are not limited, to the following:

1. Completion of Project Closeout requirements.
2. Completion of list of items remaining to be completed as indicated on the attachment to the Certificate of Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed in accordance with a schedule prepared by the Contractor which is acceptable to the Owner.
5. Transmittal of required Project construction records to the Owner (including as-built documents specified in Section 01 77 00 "Closeout Procedures").
6. Certified property survey.
7. Proof that taxes, fees, and similar obligations were paid.
8. Removal of temporary facilities and services.
9. Removal of surplus materials, rubbish, and similar elements (Reference Section 01 74 19 "Construction Waste Management & Disposal").
10. Change of door locks to Owner's access.
11. The requirements of the General Conditions and Supplementary Conditions for Final Acceptance, Final Completion, Final Inspection, and Final Payment.
12. Asbestos, lead or other hazardous material manifests.
13. Completion of "Building Contractor Reporting Form" as supplied by Department of Construction Services, for all Contractors, Subcontractors, Vendors, Suppliers, etc. who work on the Contract. The form includes the following information:
14. Contractor/Subcontractor name.
15. FEIN/Social Security Numbers
16. Connecticut Tax Registration Numbers
17. Type of work
18. Name of business and address
19. Remittance address.

End
Section 01 20 00
Contract Consideration

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01 30 00 ADMINISTRATIVE REQUIREMENTS

01 31 13 PROJECT COORDINATION

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

B. **Related Sections:** The following Sections contain requirements that relate to this section.

1. **Section 01 29 76 "Progress Payment Procedures"** submission of Schedule of Values and Applications for payment.

C. **Construction Administrator:**

1. The Construction Administrator is identified in Division 01 **Section 01 12 19 "Contract Interface".**

2. **Construction Mobilization:**

2.1 Cooperate with the Construction Administrator in the allocation of mobilization areas of the site, for field offices and sheds, for agency facility access, traffic, and parking facilities.

2.2 During Construction, coordinate use of site and facilities through the Construction Administrator.

2.3 Comply with Construction Administrators procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

2.4 Comply with instructions of the Construction Administrator for use of temporary utilities and construction facilities.

2.5 Coordinate field engineering layout as specified in Division 01 **Section 01 72 10 "Field Engineering"** for work under the instructions of the Construction Administrator.

D. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.

E. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Construction Administrator, Owner and separate contractors where coordination of their work is required.

F. **Administrative Procedures:** Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. ***Preparation of schedules.***

2. ***Installation and removal of temporary facilities.***

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project closeout activities.

G. General Coordination Provisions:

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed and coordinate such inspections with the Construction Administrator and authorities having jurisdictions. If unsatisfactory conditions exist notify the Construction Administrator immediately. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

2. The Contractor shall coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

2.1 Coordination Drawings:

1. The Construction Administrator will meet with the Contractor on all major items of coordination.

2. See also **Division 00 General Conditions, Article 7 "Cooperation of Trades".**

01 31 19 PROJECT MEETINGS

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

B. Pre-construction Conference:

1. The Contractor will attend a Pre-construction Conference before starting construction, as scheduled by the Construction Administrator convenient to the Owner, the Construction Administrator, Architect, and Contractor. This meeting will take place within **fourteen (14)** Calendar Days after the written Notice to Proceed and before the Contract Start Date. Hold the conference at the Project Site or another convenient location as directed by the Construction Administrator. The Construction Administrator shall conduct the Pre-construction Conference to review the Contractor and Subcontractor responsibilities and personnel assignments.

2. Attendees: Authorized representatives of the Construction Administrator, Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; agency; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:

3.1 Tentative construction schedule;

3.2 Critical work sequencing;

3.3 Progress meeting schedule;

3.4 Designation of responsible personnel;

3.5 Procedures for processing field decisions and Change Orders;

3.6 Procedures for processing Applications for Payment;

3.7 Distribution of Contract Documents;

3.8 Submittal of Shop Drawings, Product Data, and Samples;

3.9 Preparation of record documents;

3.10 Use of the premises;

3.11 Parking availability;

3.12 Office, work, and storage areas;

3.13 Equipment deliveries and priorities;

3.14 Safety procedures;

3.15 First aid;

3.16 Security;

3.17 Housekeeping;

3.18 Working hours;

3.19 Coordination with Audio-Visual and Telecommunications.

C. Progress Meetings:

1. The Construction Administrator will conduct progress meetings, bi-weekly, at the Project Site or at regular intervals as agreed upon at the Pre-construction Conference. The Construction Administrator will notify the Owner, the Architect, and the Contractor of the scheduled Progress Meeting dates. Coordinate dates of Progress Meetings with preparation of Application for Payment requests.

2. **Attendees:** In addition to representatives of the Contractor, Construction Administrator, Owner and the Architect, subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be requested to attend these meetings on an as needed basis. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. The Contractor shall include the site superintendent as a minimum.

3. **Agenda:** Progress Meetings shall review and correct or approve minutes of the previous Progress Meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

3.1 **Construction Schedule:** Review progress since the last Progress Meeting. Determine where each activity is in relation to the required Contractor's “Construction Schedule” and whether each activity is on time or ahead or behind Schedule. Determine how Work that is behind Schedule will be expedited; secure commitments from parties involved to do so. Discuss whether Schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.

3.2 Review the present and future needs of each entity present

4. **Reporting:** The Construction Administrator will distribute minutes of the meeting to each party present, promptly and before the next scheduled meeting, and to parties who should have been present.

5. A schedule of regular Project Meetings will be established at the Pre-construction Conference.

01 32 16 CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. This Section includes administrative and procedural requirements for the preparation, submittal, and updating of the Contractor's construction schedules and reporting progress of the Work.

1. Refer to the General Conditions and the Agreement for definitions and specific dates of Contract Time.

B. This Section includes the following:

1. Format.

2. Content.

3. Revisions to schedules.

4. Submittals.

5. Distribution.

C. **Related Sections**: The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 29 76 "Progress Payment Procedures" specifies requirements for submitting Schedule of Values and Application for Payments.

2. Division 01 Section 01 31 19 "Project Meetings" specifies requirements for submitting and distributing meeting and conference minutes.

3. Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submitting the Submittal Schedule.

4. Division 01 Section 01 45 00 "Quality Control" specifies requirements for submitting inspection and test reports.

5. Division 01 Section 01 60 00 "Product Requirements" specifies requirements for submitting the list of products.

1.3 Definitions

A. **Construction Schedule:** A method of planning and scheduling a construction project utilizing a horizontal bar chart with a separate bar for each major portion of the Work or operation to make the schedule an effective tool for planning and monitoring the progress of the work.

1.4 Quality Assurance

A. **The Contractor's Consultant:** Contractor shall provide planning, evaluating, and reporting by CPM scheduling.

1. **Program:** Use **Microsoft Project** latest version.

2. **Standards:** Comply with procedures contained in AGC's "Construction Planning & Scheduling."

1.5 Preliminary Schedule

A. Preliminary Gantt schedule is to be prepared by the General Contractor and submitted to the Construction Administrator within **seven (7)** days of award of contract. This schedule is to cover all items of Work from the start of the project up to the completion of the project. This schedule must be revised when the actual schedule of significant items varies more than one week from the proposed schedule.

1.6 Construction Schedule Format

1. **Format:** Utilize a horizontal bar chart (Gantt) with a separate bar for each major portion of the Work or operation, identifying first work day of each week.

2. **Program:** Use **Microsoft Project**, latest version.

3. **Sequence of Listings:** Utilize the Table of Contents of this Project Manual and the chronological order **of the start of each item of work.**

4. **Scale and Spacing:** Provide space for notations and revisions.

5. **Sheet Size:** To be coordinated with Construction Administrator.

6. **Weather Days Allowance:** The Contractor shall include as a separate identifiable activity on the Critical Path of the Construction Schedule, and activity labeled "Weather Days Allowance." Insert this activity immediately prior to the substantial completion milestone.

6.1 The Contractor shall be fully responsible for determining the number of weather delay days to be included in the Construction Schedule. This determination shall be based on the normal anticipated weather for the project location and the nature of the project work. The Construction Schedule shall be based on the contractor's determined weather delay allowance., The weather delay activity shall be included in the construction schedule immediately prior to the Substantial Completion milestone.

6.2 The minimal allowed duration of the Weather Days Allowance shall be calculated as follows (decimals rounded to nearest whole number):

$$\frac{\text{Contract Time } \textit{(Calendar Days)}}{365} \text{ multiplied by } 7 \text{ equals } \text{Weather Days Allowance } \textit{(Calendar Days)}$$

6.3 The Contractor shall insert an activity in the Critical Path of the Construction Schedule to reflect weather day occurrences when weather days are experienced and accepted by the Owner. Identify this activity as a weather delay.

6.4 The Contractor shall reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float. Weather delay, when justified, are considered allowable, non compensable.

1.7 Content

1. Show complete sequence of construction by activity, with dates beginning and completion of each element of construction.

2. Identify each item by specification section numbers.

3. Identify work of separate phases and other logically grouped activities.

4. Show accumulated percentages of completion of each item, and total percentage of Work completed, as of the first day of each month.

5. Provide separate schedule of submittal dates for shop drawings, product data, and samples, Owner/Agency furnished products and any products identified as under Allowances, and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.

6. Indicate delivery dates for Owner/Agency furnished products and any products identified as under Allowances.

7. Indicate critical path with original baseline indicated.

8. Coordinate content with Schedule of Values specified in Section 01 29 76 "Progress Payment Procedures."

1.8 Submittals and Revisions To Schedules

A. An initial bar graph schedule is to be prepared by the General Contractor and submitted to the Construction Administrator. Refer to Article 1.5.

B. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

C. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

D. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

E. Schedules must be revised monthly and when the actual schedule of significant items varies more than seven (7) days from the proposed schedule.

F. Submit revised Construction Schedules for each Application for Payment.

G. Submit four (4) copies of the Construction Schedule to the Construction Administrator.

1.9 Distribution

A. Distribute copies of the Construction Schedules to Construction Administrator, Architect, Owner, Subcontractors, suppliers, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problem anticipated by projections indicated in schedules.

Part 2 - Products (Not Applicable)

Part 3 - Execution (Not Applicable)

01 32 33 PHOTOGRAPHIC DOCUMENTATION

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

B. **Related Sections:** The following Sections contain requirements that relate to this section

1. **Section 01 29 76 "Progress Payment Procedures"** submission of Schedule of Values and Applications for payment.

C. On the date the work is begun and every thirty (30) days thereafter (typically at the end of the month- until the work is at least 95 percent complete), the Contractor shall have photographs of the construction taken.

D. As photographs are a record of the work progress, they shall be taken each month, whether or not they show work done during the preceding month. Deliver digital photos to the Construction Administrator within ten (10) Calendar Days of their taking.

01 33 00 SUBMITTAL PROCEDURES

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

B. **Summary**

1. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:

1.1 Submittal schedule.

1.2 Shop Drawings.

1.3 Product Data.

1.4 Samples.

1.5 Quality assurance submittals.

1.6 Proposed "Substitutions/Equals".

1.7 Warrantee samples.

1.8 Coordination Drawings.

1.9 O & M Manuals

C. **Administrative Submittals:** Refer to other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Contractor's construction schedule.
5. Daily construction reports.
6. Construction Photographs.
7. Insurance certificates.
8. List of subcontractors.
9. Subcontractors/Suppliers FEIN #'s and Connecticut tax registration #.

D. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 25 00 "Substitution Procedures" specifies requirements for submittal of requests for equals and substitutions.

2. Division 01 Section 01 29 76 "Progress Payment Procedures" specifies requirements for submittal of the Schedule of Values.

3. Division 01 Section "Project Coordination" 01 31 13 for Project Coordination documents.

4. Division 01 Section 01 31 19 "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.

5. Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.

6. Division 01 Section 01 32 33 "Photographic Documentation" specifies requirements for submittal of periodic construction photographs.

7. Division 01 Section 01 45 00 "Quality Control" specifies requirements for submittal of inspection and test reports and mockups.

8. Division 01 Section 01 77 00 "Closeout Procedures" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

9. Division 01 Section 01 78 30 "Warranties and Bonds".

E. **Definitions**

1. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Divisions 02 through 49.

1.1 Preparation of Coordination Drawings is specified in Division 01 Section 01 31 13 "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

2. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

3. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

F. Submittal Procedures

1. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

1.2 Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

1.2.1 The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

1.2.2 The Architect reserves the right to reject incomplete submitted packages.

1.3 **Processing:** To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.

1.3.1 Allow **fourteen (14)** calendar days for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.

1.3.2 If an intermediate submittal is necessary, process the same as the initial submittal.

1.4 Allow **fourteen (14)** calendar days for reprocessing each submittal.

1.5 No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

2. **Submittal Preparation:** Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Architect, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

2.1 The minimum number of copies required for each submittal shall be one (1) if provided electronically or four (4)if providing hard copies or as determined otherwise at the pre-construction conference or by the Construction Administrator.

2.2 Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2.3 Include the following information on the label for processing and recording action taken.

2.3.1 Project Name and State of Connecticut Project Number.

2.3.2 Date.

2.3.3 Name and address of the Architect, Construction Administrator, and Owner Representative.

2.3.4 Name and address of the Contractor.

2.3.5 Name and address of the subcontractor.

2.3.6 Name and address of the supplier.

2.3.7 Name of the manufacturer.

2.3.8 Number and title of appropriate Specification Section.

2.3.9 Drawing number and detail references, as appropriate.

3.10 Indicate either initial or resubmittal.

3.11 Indicate deviations from Contract Documents.

3.12 Indicate if "equal" or "substitution".

3. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Copy the Construction Administrator on the transmittal. The Architect will return all submittals to the Contractor after action is taken with a complete copy of the submittal package and one complete copy of the submittal package. The Architect will not accept submittals received from sources other than the Contractor.

3.1 On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

G. Submittal Schedule:

1. After development and review by the Owner and Architect acceptance of the Contractor's Construction or CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within fifteen (15) Calendar Days of Contract Award.

1.1 Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor’s Construction or CPM Schedule.

1.2 Prepare the schedule in chronological order. Provide the following information:

1.2.1 Schedule date for the initial submittal.

1.2.2 Related section number.

1.2.3 Submittal category (Shop Drawings, Product Data, or Samples).

1.2.4 Name of Subcontractor.

1.2.5 Description of the part of Work covered.

1.2.6 Scheduled date for resubmittal.

1.2.7 Scheduled date for the Architect’s final release of approval.

2. **Submittal Schedule:** Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

2.1 Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2.2 Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

2.3 Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

2.3.1 Submit revised submittal schedule to reflect changes in current status and timing for submittals.

3. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities.

3.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

3.2 Submit all submittal items required for each specification section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3.3 Submit action submittals and informational submittals required by the same specification section as separate packages under separate transmittals.

3.4 Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

3.4.1 Architect and Construction Administrator reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3.5 **Processing Time:** Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on the Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

3.5.1 **Initial Review:** Allow **fourteen (14)** Calendar Days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination with related submittals not yet received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals.

3.5.2 **Intermediate Review:** If intermediate submittal is necessary, process it in same manner as initial submittal.

3.5.3 **Resubmittal Review:** Allow **fourteen (14)** Calendar Days for review of each resubmittal.

3.5.4 **Mass Submittals:** Six (6)_or more submittals in one (1) Calendar Day or twenty (20) or more submittals in seven (7) Calendar Days. If “Mass Submittals” are received, Architect’s review time stated above may be extended as necessary to perform proper review. Architect will review “Mass Submittals based upon priority determined by Architect after consultation with Owner and Contractor.

3.6 **Distribution:** Following response to the initial submittal, print and distribute copies to the Construction Administrator, Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

3.6.1 When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

3.7 **Schedule Updating:** Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

H. Daily Construction Reports

1. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:

1.1 List of subcontractors at the site.

1.2 Approximate count of personnel at the site.

1.3 High and low temperatures, general weather conditions.

1.4 Accidents and unusual events.

1.5 Meetings and significant decisions.

1.6 Stoppages, delays, shortages, and losses.

1.7 Meter readings and similar recordings.

1.8 List of equipment on site and identify if idle or in use.

1.9 Orders and requests of governing authorities.

1.10 Change Orders received, start and end dates.

1.11 Services connected, disconnected.

1.12 Equipment or system tests and startups.

1.13 Partial Completion's, occupancies.

1.14 Substantial Completion's authorized.

1.15 Equals or Substitutions approved or rejected.

I. Shop Drawings

1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

2.1 Dimensions.

2.2 Identification of products and materials included by sheet and detail number.

2.3 Compliance with specified standards.

2.4 Notation of coordination requirements.

2.5 Notation of dimensions established by field measurement.

2.6 Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.

2.6.1 Submit one (1) copy electronically or four (4) hard copies as directed by the Construction Administrator. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.

2.6.2 Details shall be large scale and/or full size.

3. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Architect, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.

4. The Architect will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of the General Conditions. Shop Drawings received by the Architect that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.

5. The Contractor shall make any corrections required by the Architect and shall resubmit the required number of corrected copies of Shop Drawings until fully reviewed.

6. Upon final review submit four (4) additional prints, same as submitted, for use by the Construction Administrator.

7. The Architect's review and comments on Shop Drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.

8. Only final reviewed Shop Drawings are to be used on the Project site.

9. The Work installed shall be reviewed in accordance with the Shop Drawings and the drawings and specifications. Final Review of the Shop Drawings by the Architect shall constitute acceptance by the State and the Architect of a variation or departure that is **clearly identified**. If the contractor believes notations made by the A/E increases the value or scope of the CD's, the contractor must provide written notice to the CA within 7 days of this issue. Final reviewed Shop Drawings shall not replace or be used as a vehicle to issue or incorporate change orders or substitutions. Substitutions shall be submitted in accordance with Division 01 Section 01 25 00 "Substitution Procedures".

J. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1.1 Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

1.1.1 Manufacturer's printed recommendations.

1.1.2 Compliance with trade association standards.

1.1.3 Compliance with recognized testing agency standards.

1.1.4 Application of testing agency labels and seals.

1.1.5 Notation of dimensions verified by field measurement.

1.1.6 Notation of coordination requirements.

1.2 Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.3 **Preliminary Submittal:** Submit a preliminary single copy of Product Data where selection of options is required.

1.4 **Submittals:** Submit one (1) electronic copies or four (4) hard copies of each required submittal; submit five (5) copies where required for maintenance manuals. The Architect will retain one (1) and will return the other marked with action taken and corrections or modifications required.

1.4.1 Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

1.5 **Distribution:** Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

1.5.1 Do not proceed with installation until a copy of Product Data is in the Installer's possession.

1.5.2 Do not permit use of unmarked copies of Product Data in connection with construction.

L. Samples

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1.1 Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:

1.1.1 Specification Section number and reference.

1.1.2 Generic description of the Sample.

1.1.3 Sample source.

1.1.4 Product name or name of the manufacturer.

1.1.5 Compliance with recognized standards.

1.1.6 Availability and delivery time.

1.2 Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

1.2.1 Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

1.2.2 Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

1.2.3 Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

1.2.4 Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

1.3 **Preliminary Submittals**: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.

1.3.1 The Architect will review and return preliminary submittals with the Architects notation, indicating selection and other action.

1.4 **Submittals:** Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit one (1) electronic or four (4) hard copy sets. The Architect will return one (1) set marked with the action taken.

1.5 Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

1.5.1 Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

1.5.2 Sample sets may be used to obtain final acceptance of the construction associated with each set.

2. **Distribution of Samples:** Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

2.1 Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

2.1.1 Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

M. Quality Assurance Submittals

1. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

2. **Certifications:** Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

2.1 Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

3. **Inspection and Test Reports:** Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 45 00 "Quality Control."

N. Architect's Action:

1. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1.1 Compliance with specified characteristics is the Contractor's responsibility.

2. **Action Stamp:** The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

2.1 **Final Unrestricted Release:** When the Architect marks a submittal "Approved for fabrication," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2.2 **Final-But-Restricted Release:** When the Architect marks a submittal "Incorporate Notations," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.

2.3 **Returned for Resubmittal:** When the Architect marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

2.3.1 Do not use, or allow others to use, submittals marked "Rejected, or Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

2.4 **Other Action:** Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

3. **Unsolicited Submittals:** The Architect will discard unsolicited submittals without action.

01 35 16 ALTERATION PROJECT PROCEDURES

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

B. **Summary**

1. This Section includes administrative and procedural requirements for performing alteration and renovation Work.

2. **Related Sections:** The following Sections contain requirements that relate to this Section:

2.1 Division 01 Section 01 31 13 "Project Coordination" for procedures for coordinating cutting and patching with other construction activities.

2.2 Division 01 Section 01 73 29 "Cutting and Patching" for procedures for cutting and patching.

2.3 Division 02 Section 02 41 19 "Selective Structure Demolition" for demolition of selected portions of the building for alterations.

2.4 Refer to other Sections for specific requirements and limitations applicable to performing alteration Work with individual parts of the Work.

2.5 Requirements of this Section apply to mechanical and electrical installations. Refer to Division 21, 22, 23 and 26 Sections for other requirements and limitations applicable to renovation Work by mechanical and electrical installations.

C. **Products For Patching And Extending Work:**

1. **New Materials:** As specified in product sections; match existing Products and Work .for patching and extending Work.

2. **Type and Quality of Existing Products:** Determine by inspecting and testing Products where necessary, referring to existing Work as a standard.

F. **Inspection**

1. **General:**

1.1 Verify that demolition is complete and areas are ready for installation of new Work.

1.2 Beginning of restoration Work means acceptance of existing conditions.

2. **Project Procedures for Work Involving <u>Lead Containing Material (LBP)</u>:**

2.1 Exposure levels for lead in the construction industry are regulated by 29 CFR 1926.62. Construction activities disturbing surfaces containing lead-based paint (LBP) which are likely to be employed, such as sanding, grinding, welding, cutting and burning, have been known to expose workers to levels of lead in excess of the Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of this specification in conformance with these regulations. In addition, construction debris/waste may be classified as hazardous waste. Disposal of hazardous waste material shall be in accordance with 40 CFR Parts 260 through 271 and Connecticut Hazardous Waste Management Regulations Section 22a-209-1; 22a-209-8(c); 22a-449(c)-11; and 22a-449(c)-100 through 110.

2.2 The Contractor's Work shall be based on a child under the age of six (6) in residence; the Work shall also be in accordance with Connecticut Regulations Section 19a-111-1 through 11.

2.3 This facility was constructed prior to 1978 and is likely to have painted surfaces containing lead-based paint.

2.4 In accordance with the United States Environmental Protection Agency's (EPA) Lead-Based Paint Renovation, Repair, and Painting Program

(RRP) issued by the EPA on April 22, 2008 and regulated by 40 CFR 745, contractors performing renovation, repair and painting projects that disturb lead-based paint in homes, child care facilities, and schools built before 1978 must be certified and must follow specific work practices to prevent lead contamination. EPA requires that firms performing renovation, repair, and painting projects that disturb lead-based paint in pre-1978 homes, child care facilities and schools be certified by EPA and that they use certified renovators who are trained by EPA-approved training providers to follow lead-safe work practices. The Contractor must be a Renovation Firm that has completed an EPA Lead-Safe Certification Program and be certified to conduct lead-based paint activities and renovations under the RRP rule. The Contractor shall have at least one "Certified Renovator" assigned to jobs where LBP is disturbed.

3. Project Procedures for Work Involving <u>Asbestos Containing Material (ACM):</u>

3.1 The Owner is responsible for abating all ACM that is visible and accessible. This is to be accomplished through a separate project prior to the start of the renovation project. In demolition projects, every attempt should by the owner to remove all ACM.

3.2 If the Contractor should encounter any material suspect or known to contain ACM, he should immediately notify the Construction Administrator of same. It is the State's responsibility to have the material tested and abated (if necessary). The Owner will respond within ***twenty-four (24)*** hours after receiving the Contractor's written request to the Construction Administrator for testing the suspect material. The Owner will abate ACM (if necessary) within a reasonable time period, i.e. within **seven (7)** Calendar Days.

3.3 See also Division 00 General Conditions, Article 23 "Cutting, Fitting, Patching and Digging".

4. Project Procedures for Work Involving Products Containing Persistent Bioaccumulative Toxic Chemicals" (PBT's) such as Polychlorinated Biphenols (PCB's), Di-2-ethylhexyl Phthalate (DEHP), and Mercury:

4.1 The Contractor is responsible for abating all PCB's, DEHP, and mercury prior to the start any work involving construction, renovation or demolition (if necessary).

4.2 Exposure Levels for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's. DEHP, and mercury in the construction industry is regulated by 29CFR1910.1200 and 29CFR1926.28 et. al. Construction, renovation or demolition activities disturbing Products Containing Persistent Bioaccumulative Toxic Chemicals" (PBT's) such as PCB's and DEHP which are likely to be employed. These materials include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge (HID) lamps , and certain types of construction products containing vinyl, and mercury containing electrical switches and thermostats. These activities may expose workers in excess of the respective Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of these specifications in conformance with these regulations. In addition construction debris/waste may be classified as hazardous waste. Disposal of all hazardous materials shall be in accordance with but not limited to 40CRF Parts 761 Subpart K, 761, and 761.65 and the Connecticut General Hazardous Waste Statute Sec. 22a-454.

4.3 A Survey for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's, DEHP and Mercury has **<u>NOT</u>** been conducted at the facility. Examples include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge(HID) lamps , and certain types of construction products containing vinyl, and mercury containing electrical switches and thermostats. It is the Contractors responsibility for verification of all material and field

conditions prior to construction, renovation, and demolition that may affect the performance of their Work.

G. Preparation:

1. Cut, move, or remove items as are necessary for access to alterations and renovation Work. Replace and restore at completion.

2. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

3. Remove debris and abandoned items from area and from concealed spaces.

4. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

5. Close openings in exterior surfaces to protect existing Work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

H. Installation:

1. Coordinate Work of alterations and renovations to expedite completion and if required sequence Work to accommodate Owner occupancy.

2. Remove, cut and patch Work in a manner to minimize damage and to provide restoring Products and finishes to original and or specified condition**.**

3. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes**.**

4. In addition to specified replacement of ***equipment*** and ***fixtures***, restore existing ***plumbing, heating, ventilation, air conditioning, electrical***, systems to full operational condition.

5. Recover and refinish Work that exposes mechanical and electrical Work exposed accidentally during the Work.

6. Install Products as specified in individual sections.

8. Transitions:

1. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent Work in texture and appearance.

2. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.

9. Adjustments:

1. Where removal of partitions or walls result in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

2. Where a change of plane of ¼ inch in 12 inches or more occurs, request recommendation from Architect/Engineer for providing a smooth transition.

3. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

4. Fit Work at penetrations of surfaces as specified in Section 01045 “Cutting and Patching”.

10. Repair of Damaged Surfaces:

1. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing imperfections.

2. Repair substrate prior to patching finish.

11. Finishes:

1. Finish surfaces as specified in individual Product sections.

2. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

12. **Cleaning:**

1. In addition cleaning specified in **Section 01 77 00 "Closeout Procedures"**, clean Agency occupied areas of Work.

01 35 53 SECURITY PROCEDURES

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

B. Provide a security program and facilities to protect work, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program.

C. The General Contractor shall be solely responsible for damage, loss, or liability due to theft or vandalism.

End
Section 01 30 00
Administrative Requirements

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01 40 00 QUALITY REQUIREMENTS

A. **Summary:** Section 01 40 00 Quality Requirements contains the following Subsections:

01 42 16	**Definitions**
01 42 19	**Referenced Standards**
01 45 00	**Quality Control**
01 45 23	**Testing For Indoor Air Quality, Baseline IAQ, & Materials**

01 42 16 DEFINITIONS

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

B. **Definitions**

1. **General:** Basic contract definitions are included in the General Conditions of the Contract for Construction.

2. **"Indicated":** The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited to this term.

3. **"Directed":** Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

4. **"Approved":** The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

5. **"Regulations":** The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

6. **"Furnish":** The term "furnish" means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

7. **"Install":** The term "install" describes operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

8. **"Provide":** The term "provide" means to furnish and install, complete and ready for the intended use.

9. **"Installer":** An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

9.1 The term "experienced," when used with the term "installer," means having a minimum of five (5) previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of authorities having jurisdiction.

9.2 **Trades:** Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

9.3 **Assigning Specialists:** Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

9.3.1 This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

1. **"Project Site"**: Is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other Work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

2. **"Testing Agencies":** A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

01 42 19 REFERENCE STANDARDS

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

B. **Industry Standards:**

1. **Applicability of Standards:** Except where 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.

2. **Publication Dates:** Comply with the standards in effect as of the date of the Contract Documents unless a specific date is indicated in the Contract Documents or the governing regulations cited herein.

3. **Conflicting Requirements:** Where compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent and highest quality requirement. Request a decision from the Architect before proceeding on requirements that are different but apparently equal, and where it is uncertain which requirement is the most stringent.

4. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum acceptable. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Request a clarification from the Architect regarding uncertainties before proceeding.

5. **Copies of Standards:** Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

A. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

1. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision.

Refer to Thompson Gale's "Encyclopedia of Associations," available in most libraries.

D. Governing Regulations And Authorities:

1. Copies of Regulations: Obtain copies of the following regulations and retain at the Project Site to be available for reference by parties who have a reasonable need during submittals, planning, and progress of the Work, until Substantial Completion.

1.1 State Building Code/2005 Connecticut Supplement.

1.2 International Building Code/2003.

1.3 International Existing Building Code/2003.

1.4 International Mechanical Code/2003.

1.5 International Plumbing Code/2003.

1.6 International Energy Conservation Code/2003.

1.7 National Electric Code NFPA 70-2005.

1.8 Connecticut Fire Safety Code/2005.

1.9 ICC/ANSI A117.1-Accessible and Usable Buildings and Facilities/2003.

1.10 NFPA 101-2003.

1.11 OSHA 29 CFR Part 1910 Occupational Safety and Health Regulations/1999.

1.12 OSHA 29 CFR Part 1926 Occupational Safety and Health Regulations for Construction/1999.

E. Submittals:

1. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents.

01 45 00 QUALITY CONTROL

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

B. Summary

1. This Section includes administrative and procedural requirements for quality-control services.

2. Quality-Control services include fire alarm acceptance testing, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by the Owner.

3. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

4. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

4.1 Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

4.2 Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

4.3 Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 **Section 01 33 00 "Submittal Procedures"** specifies requirements for development of a schedule of required tests and inspections.

2. Division 01 **Section 01 77 00 "Closeout Procedures**", specific requirements for contract closeout procedures.

D. Responsibilities

1. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Owner, through the Construction Administrator, shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. All tests required by the individual specification sections are required to be scheduled and notification given to the Construction Administrator 24 / 48 hours in advance of the test/inspection as applicable. Costs for these services are not included in the Contract Sum.

1.1 Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.

1.2 Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

1.2.1 Such services include Special Inspections as required by the latest edition of the "Connecticut State Building Code".

1.2.2 Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector, as a representative of the Owner, shall document and confirm compliance with the provisions of the Connecticut State Building Code for Special Inspections.

1.2.3 Materials and assemblies for this project will be tested and construction operations inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the State for final acceptance.

1.2.4 The Owner’s use of testing and inspection services shall in no way relieve the Contractor of the responsibility to furnish materials and finished construction in full compliance with the Contract Documents and the Connecticut State Building Code.

2. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

2.1 The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated non-compliance with Contract Document requirements.

2.2 The Owner will issue a credit change order to cover all costs incurred related to all re-tests/re-inspections due to non-compliance to the Contract Documents, including but not limited to the Owner's costs and the Consultant's costs.

3. **Associated Services:** Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the Agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

3.1 Provide access to the Work.

3.2 Furnish incidental labor and facilities necessary to facilitate inspections and tests.

3.3 Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

3.4 Provide facilities for storage and curing of test samples.

3.5 Deliver samples to testing laboratories.

3.6 Provide an approved design mix proposed for use for material mixes that require control by the testing agency.

3.7 Provide security and protection of samples and test equipment at the Project Site.

4. **Duties of the Testing Agency:** The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Construction Administrator, Architect and the Contractor in performance of the testing agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

4.1 The testing agency shall notify the Construction Administrator and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

4.2 The testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

1.1 The testing agency shall not perform any duties of the Contractor.

5. Owner will pay for the services of an independent testing agency laboratory to perform inspections, tests and other services required by the Specifications except as noted below, listed for which the Owner will issue a deduct change order to cover the cost associated with these tests:

5.1 When the Contractor notifies the Construction Administrator and/or Testing Agency less than 24 hours before the expected time of testing.

5.2 When the Contractor requires testing for his own convenience.

5.3 When the Contractor schedules a test and is not ready for the required test.

6. Submit reports of tests that are part of the submittal requirements which indicate compliance or non-compliance with the specified standard.

7. See also General Conditions Article 16 "Inspections & Tests".

E. Submittals

1. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Construction Administrator. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1.1 Submit additional copies of each written report directly to the governing authority, when the authority so directs.

1.2 Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

1.2.1 Date of issue.

1.2.2 Project title and number.

1.2.3 Name, address, and telephone number of testing agency.

1.2.4 Dates and locations of samples and tests or inspections.

1.2.5 Names of individuals making the inspection or test.

1.2.6 Designation of the Work and test method.

.1 Identification of product and Specification Section.

.2 Complete inspection or test data.

.3 Test results and an interpretation of test results.

.4 Ambient conditions at the time of sample taking and testing.

.5 Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.

.6 Name and signature of laboratory inspector.

.7 Recommendations on re-testing.

F. Quality Assurance

1. **Qualifications for Service Agencies:** Engage inspection and testing service agencies, including independent testing laboratories, that are pre-qualified as complying with the National Voluntary Laboratory Accreditation Program and that specialize in the types of inspections and tests to be performed.

1.1 Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

2. **Mockups:** Provide full-size, physical assemblies that are constructed on-site. Mockups will be used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not samples. Approved mockups establish the standard by which the Work will be judged.

G. Repair and Protection

General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

1. Protect constructions exposed by or for quality-control service activities, and protect repaired construction.

2. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

End
Section 01 40 00
Quality Requirements

01 50 00 TEMPORARY FACILITIES AND CONTROLS

A. **Summary:** Section 01 50 00 Temporary Facilities And Controls contains the following subsections:

01 51 13	**Temporary Electricity And Lighting**
01 51 16	**Temporary Fire Protection**
01 51 23	**Temporary Heating, Cooling And Ventilating**
01 51 33	**Temporary Telecommunications**
01 51 36	**Temporary Water**
01 52 13	**Field Offices And Sheds**
01 52 19	**Temporary Sanitary Facilities**
01 54 00	**Construction Aids**
01 55 13	**Temporary Access Roads**
01 55 16	**Haul Routes**
01 56 00	**Temporary Barriers And Enclosures**
01 56 43	**Temporary Protection**
01 57 19	**Temporary Environmental Controls**
01 57 21	**Environmental Management**
01 57 23	**Temporary Storm Water Control**
01 57 30	**Indoor Environmental Control**
01 57 40	**Construction Indoor Air Quality Management Plan**

01 51 13 TEMPORARY ELECTRICITY AND LIGHTING

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

B. Power and lighting may be taken from the power company's nearest pole with temporary poles, if needed, to extend the line to project. If permanent power lines have been installed before beginning project, then temporary lines can be brought in from the last pole.

C. Provide service required for construction with branch wiring and distribution boxes located to provide power and lighting by construction-type extension cords. Meter shall be provided and installed by the Contractor.

D. All costs of temporary power and light shall be paid by the Contractor.

D. Connect to existing service, provide branch wiring and distribution boxes located to provide power and lighting by construction-grade extension cords. Owner will pay cost of energy used. Take measures to conserve energy. Provide lighting for construction operations. At the termination of construction, return the facilities to their original condition.

E. **Power Distribution System:** Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

F. **Temporary Lighting:** When overhead floor or roof deck has been installed, 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.

01 51 16 TEMPORARY FIRE PROTECTION

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

B. The Contractor, during construction, shall be responsible for loss or damage by fire to the work of the contractor until Acceptance of the Work. Any fire used within or near adjacent structures for working purposes shall be extinguished when not in use. No gasoline shall be stored in or close to the building at any time. The Contractor shall assign a responsible employee to be in charge of fire protection measures.

01 51 33 TEMPORARY TELECOMMUNICATIONS

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

B. **Temporary Telephone Service and Data:** The General Contractor shall provide temporary telephone service throughout the construction period for all personnel engaged in the construction activities. Install telephone on a separate line for each temporary office and first aid station. The Contractor shall provide telephone service in their offices and a separate telephone service in the Owner and CA's Office. It is preferred the Contractor use a cellular phone. Basic service and local calls will be paid for by the Contractor. Toll calls will be paid for by the respective users.

1. **Separate Telephone Lines:** Provide additional telephone lines as required below and as required by **Section 01 52 13 Field Offices and Sheds**:

1.1 Where an office has more than two (2) occupants, install a telephone for each additional occupant.

1.2 Provide dedicated telephone lines for a separate fax machine in both the Contractor's office and the CT DCS / CA office.

2. At each telephone, post a list of important telephone numbers, including but not limited to the following:

2.1 Local police and fire departments;
2.2 Ambulance service;
2.3 Construction Administrator;
2.4 Contractor;
2.5 Architect & Engineers offices;
2.6 Subcontractors;
2.7 Suppliers;
2.8 CT DCS PM;
2.9 Construction Administrator;
2.10 OSBI and OSFM Inspectors;
2.11 User Agency representative;
2.12 Camp Niantic Command Post.

C. Pay phones are available at the existing facility; the Contractor may use this equipment.

D. Public pay phones are not available at the existing facility, but the Agency, with prior notification, will make a phone available for local calls. All pay calls shall be logged and paid by the Contractor.

01 51 36 TEMPORARY WATER

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

B. **Existing Water Service:** Water for construction purposes may be taken from the existing service. The Contractor shall provide connections, approved backflow prevention device, meter and pipe to the water main or nearest hydrant, subject to the approval of the Department of Construction Services. Upon completion of work, the Contractor shall remove the temporary connections and backfill if necessary. If new water service is installed

before construction is complete, the new system may be used provided it is returned to the Owner in as-new condition. The Contractor shall pay for the water used, as metered.

01 52 13 FIELD OFFICES AND SHEDS

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

B **Support Facilities Installation:**

1. **General:** Locate field offices, storage sheds, and other temporary construction and support facilities in designated area(s) as shown in the Contract Documents or upon direction of the Connecticut Army National Guard. Final placement of the field office trailers is to be approved by the Construction Administrator.

1.1 Maintain support facilities until Acceptance of the Work. Remove prior to Acceptance of the Work with permission from the Owner.

2. **Field Offices:** Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep all offices clean and orderly, sweep weekly, and remove rubbish on a daily basis. Furnish and equip offices as follows:

C. **General Contractor Provided Field Offices/Equipment:** The General Contractor shall provide an office for their own use and a method to contact them by e-mail and telephone at any point and time.

D. **Storage and Fabrication Sheds:** Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

1. Storage sheds for tools, materials and equipment shall be weathertight with heat, lighting and ventilation for products requiring controlled conditions.

2. Remove temporary materials, equipment services and construction before Substantial Completion.

3. Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities used during construction to be specified or to original condition.

01 52 19 TEMPORARY SANITARY FACILITIES

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

B. **General Contractor's Construction Work:** Provide toilet facilities for General Contractor's and subcontractor's employees engaged on the Project, including employees of other contractors in accordance with the OSHA Table D-1 (29CFR CH.XVII, OSHA Standard 1926.51) below. Locate toilets where directed and maintain them in a sanitary condition.

Number Of Employees	Minimum Number Of Facilities*
20 or less	1 toilet
20 or more	1 toilet and 1 urinal per 40 employees
200 or more	1 toilet and 1 urinal per 50 employees
*Toilet/Urinal Combinations shall count as only one facility.	

1. Job sites, not provided with a sanitary sewer, shall be provided with one of the following toilet facilities unless prohibited by State Codes:
- **1.1** Chemical toilets;
- **1.3** Recirculating toilets;
- **1.4** Combustion toilets.

2. Inside buildings, locate toilet facilities no more than 4 stories or 60 feet above or below, nor more than 500 feet travel on the same level from the work location of any person.

3. Locate toilet facilities no more than 1000 feet from any work location.

C. The General Contractor shall provide, where directed, chemical toilets with toilet tissue, plus wash basins with water, soap and paper towels. The General Contractor shall maintain the facilities in a sanitary condition.

D. If women are employed in the work, provide separate, designated facilities for them of the same kind. Provide an adequate number of each kind of facility for each gender.

01 54 00 CONSTRUCTION AIDS

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

B. The General Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the Contract Documents except where this is otherwise specified in any Technical Specification Section. All such items shall meet the approval of the Department of Construction Services but responsibility for design, strength, and safety shall remain with the General Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the A.G.C. (Associated General Contractors of America) and the standards of the Connecticut Department of Labor (DOL).

C. Staging/laydown areas, exterior, and interior, required for the execution of the Contract Documents, shall be furnished, erected, relocated if necessary, and removed by the general Contractor. Staging/laydown shall be maintained in a safe condition without charge to the Owner and for the use of all trades as needed.

01 55 16 HAUL ROUTES

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

B. The General Contractor may use on-site paved roads and parking areas but shall not encumber same or their access. Public highways shall not be blocked by standing trucks, parked cars, material storage, and construction operations or in any other manner.

C. Public roads and existing paved roads, drives and parking areas on Owner's property shall be kept free from scrap or debris due to construction operations and any damage to their surface caused by the General Contractor shall be repaired by him at his own expense.

D. If the work of the Contract affects public use of any street, road, highway, or thoroughfare, the General Contractor shall confer with the police authority having jurisdiction to determine if and how many police are needed for public safety in addition to any barriers and signals

that may be needed. The General Contractor will be responsible for payment of any needed police services.

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

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

B. Provide barriers to prevent public entry into construction areas and to protect existing facilities from damage by construction operations.

C. Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated on the Construction Documents, or enclose the entire construction site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. **Chain Link Fence:** Provide chain link construction fencing with posts set in a compacted mixture of gravel and earth. Use a six (6) foot-high (minimum) chain link fence with top rail and filter fabric screening. At completion of the project, the Contractor must remove the construction fence completely, including all portions of below-ground footings. Fence posts must be removed, not sawn off flush with the soil line.

2. **Security Enclosure and Lockup:** Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Provide keys to the Construction Administrator.

3. **Storage/laydown areas:** Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Provide covered walkways as required by governing authorities for public rights-of-way and for public access to existing buildings.

E. Provide barriers around **all** trees and plants designated to remain. Protect against vehicular traffic, materials' dumping, chemically injurious materials, puddles, or running water.

F. Provide temporary, insulated, weathertight closures at openings to the exterior to provide acceptable working conditions and protection for materials, to allow for temporary heating and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

G. Barriers and enclosures shall be in conformance with code requirements. Do not block egress from occupied buildings unless necessary to further the work of the Contract. In this case, secure the Department's approval of an alternate egress plan.

H. See also **Division 00 General Condition, Article 19 "Protection of the Work, Persons, and Property.**

01 56 43 TEMPORARY PROTECTION

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

B. Protect buildings, equipment, furnishings, grounds, and plantings from damage. Any damage shall be repaired or otherwise made good at no expense to the State.

C. Provide protective coverings and barricades to prevent damage. The General Contractor shall be held responsible for, and must make good at his own expense, any water, or other type of damage due to improper coverings. Protect the public and building personnel from injury.

D. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

E. Provide protective coverings for walls, projections, jambs, sills and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects and storage. Prohibit traffic and storage on waterproofed and roofed surfaces and on lawn and landscaped areas.

F. See also **Division 00 General Condition, Article 19 "Protection of the Work, Persons, and Property.**

End
Section 01 50 00
Temporary Facilities and Controls

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01 60 00 PRODUCT REQUIREMENTS

A. **Summary:** Section 01 60 00 Product Requirements contains the following subsections:

01 60 00 Product Requirements

01 60 00 PRODUCT REQUIREMENTS

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

B. **Materials and Equipment:** Shall be delivered, stored and handled to prevent intrusion of foreign matter and damage by weather or breakage. Packaged materials shall be delivered and stored in original, unbroken packages.

1. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct and products are undamaged.

2. Packages, materials and equipment showing evidence of damage will be rejected and replaced at no additional cost to the Owner.

C. **Storage and Protection:**

1. Store products in accordance with manufacturers' instructions with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity range required by manufacturer.

2. 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.

3. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.

4. Arrange storage to provide access for inspection. Periodically inspect to insure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.

5. Stone, masonry units and similar materials shall be stored on platforms or dry skids and shall be adequately covered and protected against damage.

6. The Contractor shall prepare, as directed by the Owner, one area or space in the building for storage of State-owned equipment.

End
Section 01 60 00
Product Requirements

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01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

A. **Summary:** Section 01 70 00 Execution and Closeout Procedures contains the following subsections:

01 73 29	**Cutting and Patching**
01 74 13	**Progress Cleaning**
01 74 19	**Construction Waste Management & Disposal**
01 75 00	**Starting And Adjusting**
01 77 00	**Closeout Procedures**
01 78 23	**Operation And Maintenance Data**
01 78 30	**Warranties And Bonds**

01 73 29 CUTTING AND PATCHING

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

B. It is the responsibility of the Contractor to provide chases, channels or openings where needed.

C. The Contractor shall install sleeves, inserts, and hangers furnished by the trades needing same.

D. After installing work into openings, channels, and/or chases, the Contractor shall close same. If finishes are to be restored, the new work shall match the original and shall be done by the trade customarily responsible for the particular kind of work.

E. Written permission shall be obtained from the Contractor before cutting beams, arches, lintels or other structural members.

F. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Contractor shall obtain written approval from the Architect/Engineer of the cutting and patching proposal before cutting and shall submit all A/E approval letters to the Construction Administrator before patching the following structural elements:

1.1 Foundation construction.

1.2 Bearing and retaining walls.

1.3 Structural concrete.

1.4 Structural steel.

1.5 Lintels.

1.6 Structural decking.

1.7 Miscellaneous structural metals.

1.8 Exterior curtain-wall construction.

1.9 Equipment supports.

1.10 Piping, ductwork, vessels, and equipment.

1.11 Structural systems of special construction in Division 13 Sections.

G. Do cutting and patching to integrate all elements of the work. Provide penetrations of existing surfaces. Provide samples for testing. Seal penetrations through floors, walls, ceilings, and roofs, as applicable; restore or preserve fire-rated and smoke-barrier construction. Construction and finishes shall match original work.

H. The Contra shall verify dimensions for built-in work and/or work adjoining that of other trades before ordering any material or doing any work. Discrepancies shall be submitted to the Construction Administrator before proceeding with the work.

I. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

J. Also see Division 00 General Conditions **Article 23 "Cutting, Fitting, Patching, and Digging",**

01 74 13 PROGRESS CLEANING

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

B. **This Section includes:**
- **1.** Cleaning requirements during construction operations.
- **2.** Final cleaning prior to turning the project over to the Owner.

C. **Quality Assurance**
- **1.** Coordinate with **Section 01 57 19 - Environmental Management.**
- **2.** Coordinate with **Section 01 77 00– Close out Procedures.**
  - **2.1** Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.

D. Utilize non-toxic cleaning materials and methods.
- **1.** Use natural cleaning materials where feasible. Natural cleaning materials include:
  - **1.1** abrasive cleaners: substitute 1/2 lemon dipped in borax.
  - **1.2** ammonia: substitute vinegar, salt and water mixture, or baking soda and water.
  - **1.3** disinfectants: substitute 1/2 cup borax in gallon water.
  - **1.4** drain cleaners: substitute 1/4 cup baking soda and 1/4 cup vinegar in boiling water.
  - **1.5** upholstery cleaners: substitute dry cornstarch.

E. Maintain areas under the General Contractor's control free of waste materials, debris, and rubbish. Maintain in a clean and orderly condition.

F. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces before closing the space.

G. Periodically clean interior areas before start of surface finishing and continue cleaning on an as-needed basis.

H. The General Contractor shall control cleaning operations so that dust and other particulates will not adhere to wet or newly-coated surfaces.

I. Remove waste materials, debris, and rubbish from site daily and dispose of legally off-site. No scrap/debris shall remain inside the building or anywhere on site upon final acceptance of the project.

J. **Final Cleaning:**
- **1.** At completion of Work, remove all remaining waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave Project clean and ready for occupancy.
  - **1.1** After review of trees to remain by Architect and Owner, remove tree tags.
  - **1.2** Provide final cleaning in accordance with ASTM E1971 and the approved Integrated Pest management (IPM) plan.

K. See also **Division 00 General Conditions, Article 24 "Cleaning Up".**

01 74 19 CONSTRUCTION WASTE MANAGEMENT & DISPOSAL

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

B. **Summary:** This Section includes requirements for waste management goals, waste management plan and waste management plan implementation.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 **Section 01 11 00 "Summary of Work".**

2. Division 01 **Section 01 20 00 "Contract Considerations".**

3. Division 01 **Section 01 25 00 "Substitution Procedures".**

4. Division 01 **Section 01 31 19 "Project Meetings".**

5. Division 01 **Section 01 33 00 "Submittal Procedures".**

6. Division 01 **Section 01 45 00 "Quality Control".**

7. Division 01 **Section 01 50 00 "Temporary Facilities and Controls".**

8. Division 01 **Section 01 60 00 "Product Requirements".**

9. Division 01 **Section 01 77 00 "Closeout Procedures".**

10. Division 01 **Section 01 83 13 "Sustainable Design Requirements".**

D. **Definitions:**

1. **Construction Waste:** Solid wastes such as building materials, packaging and rubble resulting from construction, paving and infrastructure.

E. **Demolition Waste:** Solid wastes such as concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, and clean fill resulting from demolition or selective demolition of structures.

F. **Recyclable Materials:** Products and materials that can be recovered and remanufactured into a new product. Recyclable materials include, but are not limited to, the following:

1. Metals (ferrous and non-ferrous), including banding, metal studs, ductwork, and piping.

2. Asphaltic concrete paving.

3. Portland cement concrete.

4. Gypsum products.

5. Paper and cardboard.

6. Wood products, including structural, finish, crates, and pallets.

7. Brick and masonry.

8. Carpet and padding.

9. Plastics.

10. Copper wiring.

G. **Recycling Facility:** A business that specializes in collecting, handling, processing, distributing, or remanufacturing waste materials generated by new construction projects, into products or materials that can be used for this project or by others.

H. **Salvage and Reuse:** Existing usable product or material that can be saved and reused in some manner on the project site. Materials for reuse must be approved by the Architect. Materials that can be salvaged and reused must comply with applicable technical specifications and include, but are not limited to, the following:

1. Dimensional lumber and other wood products.

2. Structural steel.

3. Soil.

4. Masonry products.

5. Plants.

I. **Salvage for Resale:** Existing usable product that can be saved and removed intact (as is) from the project site to another site for resale to others without remanufacturing.

J. **Waste Management Goals:**

1. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

2. The General Contractor shall use all means available to divert the greatest extent practical and economically feasible, construction waste from landfills and incinerators.

3. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

4. Recycle and/or salvage a minimum of 50 percent of non-hazardous construction and demolition waste by weight of the total solid waste generated by the Project.

5. With regard to these goals the General Contractor shall develop, for the Architect's and Owner's CA review, a Waste Management Plan for this Project.

6. Take a pro-active, responsible role in management of construction waste and require all subcontractors, vendors, and suppliers to participate in the effort. Establish a construction waste management program that includes the following categories:

6.1 Minimizing packaging waste.

6.2 Salvage and reuse.

6.3 Salvage for resale or donation.

6.4 Recycling.

6.5 Disposal.

K. **Submittals:**

1. **Draft Waste Management Plan:** Within thirty (30) Calendar days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner, the general Contractor shall submit three (3) copies of a Draft Waste Management Plan to the Construction Administrator.

2. **Final Waste Management Plan:** Once the Owner has determined which of the recycling options addressed in the Draft Waste Management Plan are acceptable, the general Contractor shall submit within ten (10) Calendar days three (3) copies of a Final Waste Management Plan.

3. **Progress Reports:** Submit three (3) copies of monthly progress reports, at the same time as the Application for Payment, documenting the following:

3.1 Material category.

3.2 Point of waste generation.

3.3 Total quantity of waste in tons.

3.4 Quantity of waste salvaged, in tons.

3.5 Quantity of waste recycled, in tons.

3.6 Total quantity of waste recovered (salvaged plus recycled) in tons.

3.7 Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

4. **Calculations:** Submit three (3) copies of calculations indicating the end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Project prior to Substantial Completion.

5. **Record Submittals:**

5.1 **Donations:** Indicate which salvageable materials were donated, who they were donated to, and whether the recipient is tax exempt. Submit documentation indicating receipt of donations.

5.2 **Sales:** Indicate which salvageable materials were sold, who they were sold to, and whether the recipient is tax exempt. Submit documentation indicating receipt of materials.

5.3 **Recycling:** Indicate which materials were recycled and the name of the facility licensed to accept them. Submit documentation such as manifests, weight tickets, receipts, and invoices.

5.4 **Waste Disposal:** Indicate which materials were accepted as waste by landfills and incinerator facilities licensed to accept them. Submit documentation indicating receipt of materials.

L. **Quality Assurance:**

1. **Regulatory Requirements:** Comply with regulations of State of Connecticut Department of Environmental and Energy Protection, Reduce/Reuse/Recycle Program.

2. **Waste Management Conference:** Review and discuss the waste management plan, requirements for documenting quantities of each type of waste and its disposition, procedures for materials separation, procedures for periodic collection and transportation to recycling and disposal facilities. Review waste management requirements for each trade. Verify availability of containers and bins needed to avoid delays.

M. **Waste Management Plan:**

1. **Draft Waste Management Plan:** Include the following in the Draft Plan:

1.1 Analysis of the proposed jobsite waste to be generated, including types and quantities.

1.2 **Landfill Options:** The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).

1.3 **Alternatives to Landfilling:** A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated net cost savings or additional costs resulting from separating and recycling (versus landfilling) each material. "Net" means that the following have been subtracted from the cost of separating and recycling:

1.3.1 Revenue from the sale of recycled or salvaged materials and

1.3.2 Landfill tipping fees saved due to diversion of materials from the landfill. The list of these materials is to include, at a minimum, the following materials:

.1 Cardboard.

.2 Clean dimensional wood.

.3 Beverage containers.

.4 Land clearing debris.

.5 Concrete.

.6 Bricks.

.7 Concrete Masonry Units (CMU).

.8 Asphalt.

.9 Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet

steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

N. **Resources for Development of Waste Management Plan:** The following sources may be useful in developing the Draft Waste Management Plan:

1. **Recycling Haulers and Markets:** Local haulers and markets for recyclable materials. For more information, contact the State of Connecticut Department of Environmental and Energy Protection, Reduce/Reuse/Recycle Program:
2. http://www.ct.gov/deep/site/default.asp

O. **Final Waste Management Plan:** The Final Waste Management Plan shall contain the following:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.
2. **Landfill Options:** The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
3. **Alternatives to Landfilling:** A list of the waste materials from the Project that will be separated for reuse, salvage, or recycling.
4. **Meetings:** A description of the regular meetings to be held to address waste management. Refer to **Section 01 31 19 "Project Meetings".**
5. **Materials Handling Procedures:** A description of the means by which any waste materials identified in item (3) above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
6. **Transportation:** A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

P. **Waste Management Plan Implementation:**

1. **Manager:** The General Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
2. **Distribution:** The General Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Architect.
3. **Instruction:** The General Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
3. **Separation Facilities:** The General Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
4. **Hazardous Wastes:** Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
5. **Application for Progress Payments:** The General Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:

5.1 The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.

5.2 For each material recycled, reused, or salvaged from the Project: the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling of each material shall be indicated. Attach manifests, weight tickets, receipts, and invoices.

Q. Plan Implementation:

1. Implement the waste management plan as approved by Owner and Construction Administrator and Agency Construction Coordinator.

2. Provide training of workers, contractors, subcontractors, and suppliers on proper waste management procedures.

2.1 Distribute waste management plan to all parties involved in the Project within three (3) Calendar Days of submittal return.

2.2 Distribute plan to parties when they first begin working on the Project site. Review plan procedures and locations established for salvage, recycling, and disposal.

R. Separation of Recyclable Waste Materials:

1. Provide the necessary containers and bins, to facilitate the waste management program, that are clearly and appropriately marked. Prevent contamination of recyclable materials from incompatible products and materials. Separate construction waste at the project site by one of the following methods:

1.1 **Source Separated Method:** Waste products and materials, that are recyclable, are separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Trash is transported to a landfill or incinerator.

1.2 **Co-Mingled Method:** All construction waste is placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed and the remaining trash is transported to a landfill or incinerator.

1.3 Other methods proposed by the Contractor and approved by the Owner, Construction Administrator.

01 77 00 CLOSEOUT PROCEDURES

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

B. Substantial Completion:

1. Upon completion of the work, the General Contractor shall submit to the State a Certificate of Substantial Completion wherein the General Contractor certifies that all conditions of the Contract Documents have been met, and that the facility is ready for occupancy by the Agency. Issuance of a Certificate of Substantial Completion by the Owner shall be a pre-condition for payment by the Owner.

1.1 Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.

1.2 In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent (100%) completion for the portion of the Work claimed as substantially complete.

1.2.1 Include supporting documentation for completion as indicated in the Contract Documents and a statement showing all accounting of the Contract Documents.

1.2.3 If 100 percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete shall be provided as well as a schedule for completion of work.

1.3 Advise the Owner of pending insurance changeover requirements.

1.4 Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

1.5 Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

1.6 Submit as-built record drawings, maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

1.7 Deliver tools, spare parts, extra stock, and similar items.

1.8 Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

1.9 Demonstration, through operation and testing, the functions of all systems and/or equipment to the satisfaction of the Owner for compliance to the contract. Complete testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

1.10 Complete final cleanup requirements, including touchup painting.

1.11 Touch up and otherwise repair and restore marred, exposed finishes.

1.12 Compliance with other terms as outlined in the Contract Documents.

1.13 List of all the General Contractor’s suppliers, sub-contractors, etc. Include name of firm, address, FEIN number and CT Tax I.D. number.

2. **Inspection Procedures:** The General Contractor shall be ready and prepared when they request a Substantial Completion inspection. If the inspection reveals that the work is not complete, there are extensive punchlist items and as the items listed above are not complete, the Construction Administrator, Owner, and Agency will determine the inspection has failed.

3. The General Contractor is responsible for all costs to re-inspect due to a failed inspection.

3.1 The General Contractor will repeat inspection when requested and assured that the Work is substantially complete.

3.2 Results of the completed inspection will form the basis of requirements for Acceptance of the Work.

C. Acceptance of the Work

1. **Preliminary Procedures:** Before requesting a Final Inspection and Certificate of Acceptance and Final Payment, complete the following. List exceptions in the request.

1.1 Submit a request for the Final Inspection and Certificate of Acceptance, with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed

operations where required. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

1.2 Submit a certified copy of the Architect's Final Inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.

1.3 Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.

1.4 Submit consent of surety to Final Payment.

1.5 Submit evidence of final, continuing insurance coverage complying with insurance requirements.

D. **Reinspection Procedure:** The Inspection Group will re-inspect the Work upon receipt of notice from the Construction Administrator that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

1. Upon completion of re-inspection, the Construction Administrator will prepare a Certificate of Acceptance for issuance by the Owner. If the Work is incomplete, the Construction Administrator will advise the General Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Acceptance.

E. Issuance of a Certificate of Acceptance, in accordance with CGS § 4-61(b)(2) as amended, by the Owner does not alter the responsibility of the General Contractor to complete all Work in accordance with the Contract Documents.

F. **General Contractor's As-Built Drawings Submittal:**

1. General: The General Contractor shall not use the As-Built Drawings for construction purposes. Protect General Contractor's As-Built Drawings from deterioration and loss in a secure, fire-resistant location. Provide access to the As-Built Drawings for Owner's and Construction Administrator's reference during normal working hours. Keep documents current; do not permanently conceal any work until required information has been recorded. Failure to keep documents current is sufficient cause to withhold progress payments.

1.1 The General Contractor shall also engage the services of a Surveyor registered in the State of Connecticut to conduct a final survey to determine the location of exterior underground utility lines and to record the results, and update existing electronic media.

1.2 The record of exterior underground utilities shall be made at the time of installation on Mylar film drawing and AutoCAD (latest version) compatible disks. The drawing shall bear the seal of the Land Surveyor and a statement of accuracy.

2. General Contractor's As-Built Drawings: The General Contractor shall maintain one clean, complete undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. **Failure to keep As-built Documents current is sufficient cause to withhold progress payments.**

2.1 Mark record sets with erasable pencil to distinguish between variations in separate categories of the Work.

2.2 Mark all new information that is not shown on Contract Drawings.

2.3 Note related Agreement Amendments where applicable.

2.4 Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

2.5 Upon completion of the work, the General Contractor shall submit Record Drawings to the Construction Administrator for the Owner's Records who will pass them on to the Architect or Engineer for transferring the changes to the Record Drawing Mylar Tracings.

2.6 Submit electronic format data of all Coordination Drawing drawings as required by the owner.

2.7 Refer to Section **01 45 00 "Quality Control"** Paragraph **8.3.6** for required as-built drawings and specifications for fire alarm systems.

2.8 Upon completion of the work, the General Contractor shall submit Record Drawings to the Architect and/or Engineer for transferring the changes to the Record Drawings.

G. **General Contractor's Record Documents:** Within **thirty (30)** Calendar Days after receipt of the General Contractor's "As-Built Drawings" the Architect/Engineers shall convert the General Contractor "As-Built" information into an electronic CADD format as required by the Owner, using the original A/E contract documents as base drawings. The Architect shall produce "Record Documents" that show all of the significant modifications made during the course of the project.. The Architect's shall produce two (2) sets of electronic CADD format "Record Documents" on electronic media as required by the Owner and (1) set of reproducible Mylar's "Record Documents". The original Mylar "Cover Sheet" that includes the original A/E Team Members dated signatures and professional seals shall be the Record Documents Cover Sheet. The Architect's final "Record Documents" (electronic media and reproducible Mylar's) shall be made at the Architect's expense and shall become the property of the State.

H. **General Contractor's Record Specifications:** The General Contractor shall maintain one complete copy of the Project Manual, Include with the Project Manual one copy of other written construction documents, such modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to the Technical Specifications and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.

3. Note related record drawing information and Product Data.

4. Upon completion of the Work, submit record Specifications to the Construction Administrator for the Owner's records.

I. **General Contractor's As-Built Product Data:** The General Contractor shall maintain one copy of each As-Built Product Data submittal and a markup of record drawings and As-Built Specifications.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.

3. Upon completion of markup, submit complete set of As-Built Product Data to the Construction Administrator for the Owner's records.

4. The Architect and Engineers will be responsible for the accuracy of As-Built Drawings.

J. **General Contractor's Record Sample Submitted:** Immediately prior to Substantial Completion, the appropriate A/E Team Members shall meet with the Owner, Construction

Administrator, and the Agency's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner/Agency instructions regarding delivery to the Owner/Agency Sample storage area.

K. **General Contractor's Miscellaneous Record Submittals:** Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Construction Administrator for the Owner's records.

L. **Maintenance Manuals:** Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder according to Section **01 78 23 "Operation and Maintenance Data"**. The manual shall include, but not be limited to, the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.
9. List of vendors and addresses.

M. **Closeout Procedures:**

1. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Agency's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1.1 Maintenance manuals.
1.2 Record documents.
1.3 Spare parts and materials.
1.4 Tools.
1.5 Lubricants.
1.6 Fuels.
1.7 Identification systems.
1.8 Control sequences.
1.9 Hazards.
1.10 Cleaning.
1.11 Warranties and bonds.
1.12 Maintenance agreements and similar continuing commitments.

7. **2.** As part of instruction for operating equipment, demonstrate the following procedures:

2.1 Startup.

2.2 Shutdown.

2.3 Emergency operations.

2.4 Noise and vibration adjustments.

2.5 Safety procedures.

2.6 Economy and efficiency adjustments.

2.7 Effective energy utilization.

N. Final Cleaning:

1. **General:** The Contract Documents require general cleaning during construction. Regular site cleaning is included in **Section 01 74 13 "Progress Cleaning".**

2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and Certification of Occupancy.

3. **Interior:**

3.1 Remove labels that are not permanent labels.

3.2 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

3.3 Clean exposed interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

3.4 Wash washable surfaces of mechanical, electrical equipment and fixtures and replace filters, clean strainers on mechanical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

3.5 Clean and polish finish hardware.

3.6 Clean and polish tile and other glazed surfaces.

3.7 Clean floors; wax and buff resilient tile. Clean vinyl or rubber base.

3.8 Vacuum and/or dust walls, ceilings, lighting fixtures, ceiling diffusers and other wall and ceiling items.

3.9 Remove defacements, streaks, fingerprints, and erection marks.

4. **Exterior:**

4.1 Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth, even-textured surface.

4.2 Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances

4.3 Clean roofs, gutters and downspouts.

4.4 Remove waste and surplus materials, rubbish and construction equipment and facilities from the site, and deposit it legally elsewhere.

4.5 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

5. **Pest Control:** Engage an experienced, licensed exterminator to make a final inspection and rid the work of rodents, insects, and other pests.

6. **Removal of Protection:** Remove temporary protection and facilities installed for protection of the Work during construction.

7. **Compliance:** Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Agency's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

7.1 Where extra materials of value remain after completion of associated Work, they become the Agency's property. Dispose of these materials as directed by the Construction Administrator.

7.2 Leave building clean and ready for occupancy. If the Design Builder fails to clean up, the Owner may do so, with the cost charged to the Developer.

O. Prerequisites To Functional Completion

1. All TAB work and the commissioning of systems must be complete prior to Functional Completion, unless approved in writing by the Owner's Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1.1 Completed and signed start-up and prefunctional checklist documentation;
1.2 Requested trend log data;
1.3 Submission of final approved TAB report;
1.4. Completion of all functional testing;
1.5 Required training of Owner personnel completed and approved;
1.6 Submission of the approved O&M manuals;
1.7 All identified deficiencies have been corrected or are approved by the Owner to be accepted from this milestone.

2. The Owner's Project Manager (PM) and Construction Administrator will determine the date of Functional Completion after reviewing the Commissioning Authority (CxA) Agent's recommendation for Functional Completion.

01 78 23 OPERATION AND MAINTENANCE DATA

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

B. **Summary:** This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:

1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.

2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.

D. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 01 Section **01 33 00 "Submittal Procedures"** specifies preparation of Shop Drawings and Product Data.
2. Division 01 Section **01 75 00 "Starting and Adjusting"** specifies instruction of the Owner and Agency operating personnel in the operation and maintenance of building systems and equipment and the general requirements for starting-up equipment and systems.
3. Division 01 Section **01 77 00 "Closeout Procedures"** specifies general closeout requirements.
4. Division 01 Section **01 78 30 "Warranties and Bonds"** specifies requirements for submittal of warranties and bonds.
5. Division 01 Section **01 81 13 "Sustainable Design Requirements"** specifies requirements for submittals related to green building certification.
6. Appropriate Sections of the Divisions 02 through 49 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.

E. Quality Assurance

1. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.

1.1 Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.

1.2 Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.

2. Instructions for the Owner and Agency Personnel: The Contractor must use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved, to instruct the Owner's operation and maintenance personnel.

F. Submittals:

1. **Submittal Schedule:** Comply with the following schedule for submitting operation and maintenance manuals:

1.1 Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit two (2) draft copies of each manual to the Construction Administrator for review. Include a complete index or table of contents of each manual.

1.1.1 The Construction Administrator will return one (1) copy of the draft with comments within twenty-one (21) Calendar Days of receipt.

1.1.2 Submit three (3) copies of data in final form at least twenty (21) Calendar Days before final inspection. The Construction Administrator will return one (1) copy within twenty (21) Calendar Days after final inspection, with comments.

2. After final inspection, make corrections or modifications to comply with the Architect's comments. Submit final copies to the Construction Administrator within twenty (21) Calendar Days of receipt of the Architect's comments.

3. **Form of Submittal:** Prepare operation and maintenance manuals in the form of an instructional manual for use by the Military Department's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

4. **Binders:** For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11- inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

   4.1 Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

   1.2 Identify each binder on front and spine, with the printed title **"OPERATION AND MAINTENANCE MANUAL"**, Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

5. **Dividers:** Provide heavy paper dividers with celluloid-covered tabs for each separate section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the section on each divider.

6. **Protective Plastic Jackets:** Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

7. **Text Material:** Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch, 20-lb/sq ft white bond paper.

8. **Drawings:** Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

   5.1 Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.

   5.2 If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

G. Manual Content

1. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:

1.1 General system or equipment description.

1.2 Design factors and assumptions.

1.3 Copies of applicable shop drawings and product data.

1.4 System or equipment identification, including:

1.4.1 Name of manufacturer.

1.4.2 Model number.

1.4.3 Serial number of each component.

1.5 Operating instructions.

1.6 Emergency instructions.

1.7 Wiring diagrams.

1.8 Inspection and test procedures.

1.9 Maintenance procedures and schedules.

1.10 Precautions against improper use and maintenance.

1.11 Copies of warranties.

1.12 Repair instructions including spare parts listing.

1.13 Sources of required maintenance materials and related services.

1.14 Manual index.

2. Organize each manual into separate sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of product data, supplemented by drawings and written text; and copies of each warranty, bond, and service contract issued.

2.1 **Title Page:** Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:

2.1.1 Subject matter covered by the manual.

2.1.2 Name and address of the Project.

2.1.3 Date of submittal.

2.1.4 Name, address, and telephone number of the Contractor.

2.1.5 Name and address of the Architect and Construction Administrator.

2.1.6 Cross-reference to related systems in other operation and maintenance manuals.

2.2 **Table of Contents**: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.

2.2.1 Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.

2.3 Provide a general information section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.

2.4 **Product Data:** Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one (1) item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.

2.5 **Written Text**: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.

2.6 **Drawings:** Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.

2.6.1 Do not use original Record Documents as part of operation and maintenance manuals.

2.7 **Warranties and/or Bonds:** Provide a copy of each warranty and/or bond in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

H. Material And Finishes Maintenance Manual:

1. Submit four (4) copies of each manual, in final form, on material and finishes to the Construction Administrator for distribution. Provide one (1) section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.

1.1 Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

2. **Architectural Products:** Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.

2.1 **Manufacturer's Data:** Provide complete information on architectural products, including the following, as applicable:

2.1.1 Manufacturer's catalog number.

2.1.2 Size.

2.1.3 Material composition.

2.1.4 Color.

2.1.5 Texture.

2.1.6 Reordering information for specially manufactured products.

2.2 **Care and Maintenance Instructions:** Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.

3. **Moisture Protection and Products Exposed to the Weather:** Provide complete manufacturer's data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.

3.1 **Manufacturer's Data:** Provide manufacturer's data giving detailed information, including the following, as applicable:

3.1.1 Applicable standards.

3.1.2 Chemical composition.

3.1.3 Installation details.

3.1.4 Inspection procedures.

3.1.5 Maintenance information.

3.1.6 Repair procedures.

I. Equipment And Systems Maintenance Manual:

1. Submit four (4) copies of each manual, in final form, on equipment and systems to the Construction Administrator for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

1.1 Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.

2. **Equipment and Systems:** Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

2.1 **Description:** Provide a complete description of each unit and related component parts, including the following:

2.1.1 Equipment or system function.

2.2.2 Operating characteristics.

2.1.3 Limiting conditions.

2.1.4 Performance curves.

2.1.5 Engineering data and tests.

2.1.6 Complete nomenclature and number of replacement parts.

2.2 **Manufacturer's Information:** For each manufacturer of a component part or piece of equipment, provide the following:

2.1.1 Printed operation and maintenance instructions.

2.1.2 Assembly drawings and diagrams required for maintenance.

2.1.3 List of items recommended to be stocked as spare parts.

2.3 **Maintenance Procedures:** Provide information detailing essential maintenance procedures, including the following:

2.4 **Operating Procedures:** Provide information on equipment and system operating procedures, including the following:

2.4.1 Startup procedures.

2.4.2 Equipment or system break-in.

2.4.3 Routine and normal operating instructions.

2.4.4 Regulation and control procedures.

2.4.5 Instructions on stopping.

2.4.6 Shutdown and emergency instructions.

2.4.7 Summer and winter operating instructions.

2.4.8 Required sequences for electric or electronic systems.

2.4.9 Special operating instructions.

2.5 **Servicing Schedule:** Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

2.6 **Controls:** Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

2.7 **Identification Drawings:** Provide each Contractor's Identification Drawings.

2.7.1 Provide as-installed, color-coded, piping diagrams, where required for identification.

2.8 **Valve Tags**: Provide charts of valve-tag numbers, with the location and function of each valve.

2.9 **Circuit Directories:** For electric and electronic systems, provide complete circuit directories of panel boards, including the following:

2.9.1 Controls.

2.9.2 Communication.

3. **Electronic Media:**

3.1 For equipment which requires maintenance by operational personnel, provide a professionally developed DVD for the use of maintenance training for the facility. Each DVD will be accompanied by a written index which can be utilized to find any specific item of information by time or place on the DVD.

3.2 The General Contractor is responsible for this production. This DVD will be provided to the Construction Administrator at the same time as the delivery of the other maintenance material.

3.3 The DVD must be able to be edited for future changes to the equipment and modifications as they occur.

01 78 30 WARRANTIES AND BONDS

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

B. **Summary:** This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the General Contractor's period for correction of the Work.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 33 00 **"Submittal Procedures"** specifies procedures for submitting warranties.

2. Division 01 Section 01 77 00 **"Closeout Procedures"** specifies contract closeout procedures.

3. Division 01 Section 01 78 23 **"Operation and Maintenance Data"** specifies required operation and maintenance data.

4. The Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

5. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

D. **Disclaimers and Limitations**: Manufacturer's disclaimers and limitations on product warranties do not relieve the General Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with the General Contractor.

E. **Related Damages and Losses:** When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

F. **Reinstatement of Warranty:** When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

G. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The General Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

H. **Owner's Recourse:** Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. **Rejection of Warranties:** The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the General Contractor presents evidence that entities required to countersign such commitments are willing to do so.

J. The General Contractor shall warranty all materials and workmanship for a period of eighteen months from the date of Acceptance of the Work. In addition, the Contractor shall furnish the warranties listed below. Submit four copies of each to the Architect in the supplier's standard form or in the form given below if there is no standard form available.

K. The General Contractor shall warranty all materials and workmanship for a period of **eighteen** (**18)** months from the date of Acceptance of the Work. In addition, the General Contractor shall furnish the warranties listed below. Submit four copies of each to the Architect in the supplier's standard form or in the form given below if there is no standard form available.

L. Form of Warranty: Warranties shall be submitted in following format:

Warranty

Commissioner
Department of Construction Services
165 Capitol Avenue
Hartford, Connecticut 06106

Project Number: *(Insert CT DCS Project Number)*
Project Title: *(Insert Project Title)*

I (We) hereby warranty

the _____ ***work on the referenced project for a period of*** _____ ***years***

from _____ ***, 20*** _____ ***against failures of workmanship and materials in accordance***

with the requirements of Section _____ ***, Page*** _____ ***, Paragraph*** ***1.04*** ***, of the Specifications.***

Installer ☐ | ***Subcontractor*** ☐ | ***Vendor/Suppliers*** ☐ | ***Manufacturer*** ☐

Installer or Subcontractor or Vendor/Suppliers or Manufacturer Name: _____

Installer or Subcontractor or Vendor/Suppliers or Manufacturer Signature:	_____
General Contractor's Name	_____
General Contractor's Signature:	_____
or	
General Contractor's Authorized Agent Signature:	_____

M. Bonds shall be by approved Surety Companies, made out to the Commissioner, Department of Administrative Services on companies' standard form.

N. Warranties, Guarantees, or bonds supplied by the General Contractor's Subcontractors or Vendors/Suppliers or Manufacturers shall reference the project name, number, and location and be certified by the General Contractor to be for the product and installation on the project and must be countersigned by the General Contractor.

O. **Submittals**:

1. Submit written warranties prior to the date certified for Substantial Completion. If the General Contractor's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

2. Forms for special warranties are included in this Section. Prepare a written document utilizing the appropriate form, ready for execution by the General Contractor's, and by the General Contractor's subcontractor or vendor/supplier, or manufacturer. Submit a draft to the Owner, through the Construction Administrator, for approval prior to final execution.

2.1 Refer to the Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

3. **Form of Submittal:** At Acceptance of the Work compile two (2) copies of each required warranty properly executed by the General Contractor, and by the General Contractor's subcontractor or vendor/supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

4. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch by-11-inch paper.

4.1 Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

4.2 Identify each binder on the front and spine with the typed or printed title "WARRANTIES," CT DCS Project Number, Project Title, name of the General Contractor, and name of General Contractor's subcontractor or vendor/supplier, or manufacturer.

4.3 When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

End
Section 01 70 00
Execution and Closeout Procedures

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Establishment of lines, benchmarks, and elevations required to layout and construct the Work. Including all roadway, curbing, storm, sanitary and utility work.

1.2 SUBMITTALS

A. Informational Submittals

1. Submit the qualifications of the Registered Professional Engineer and/or Registered Land surveyor to be hired to perform various portions of the Work, as applicable.

2. Submit documentation verifying the accuracy of field engineering work.

3. Submit 4 copies of final record drawings of field engineering layouts and as-built survey.

4. Submit certificate signed by registered (licensed) engineer or surveyor certifying that elevations and locations of Work are in conformance with Contract Documents. Explain deviations.

1.3 RECORDS

A. Maintain a complete, accurate log of control and survey work as it progresses.

1.4 QUALITY ASSURANCE

A. Employ a qualified engineer, registered with the State of Connecticut as a Professional Engineer or a competent surveyor, registered with the State of Connecticut as a Land Surveyor, as required for the particular characteristics of the work being performed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROCEDURES

A. The Registered Professional Engineer or Land Surveyor provided shall establish and maintain lines, elevations and reference marks needed during the progress of the Work and shall re-establish stakes and marks placed by the Engineer that are lost or destroyed through the course of the Work. Verify such work by instrument or other appropriate means.

B. The Engineer shall be permitted at all times to check the lines, elevations and reference marks, set by the Contractor, who shall correct any errors disclosed by such check. Such a check shall not be construed to be an approval of the Contractor's work and shall not relieve or diminish the responsibility of the Contractor for the accurate and satisfactory construction and completion of the entire Work.

C. Make, check, and be responsible for measurements and dimensions necessary for the proper construction of and the prevention of misfittings in the Work.

D. Furnish all protective stakes and temporary structures for marking and maintaining points and lines for the building of the Work, and give the Engineer such facilities and materials for verifying said lines and points as he may require.

E. Revisions to the layout and elevations of the Work as defined by the Contract Documents shall be approved by the Engineer.

F. Maintain and prepare final record drawings of field engineering layouts and as-built survey conducted after completion of the Work.

G. Submit the pre-construction letter of certification as outlined in Part 1 above.

H. NOT USED

I. Survey all first floor elevations, all sewer outlet elevation at the face of buildings, and all downstream sewer manhole connection points to confirm all inverts and top of frame elevations in all areas of proposed sanitary sewer, sanitary laterals and catch basin installations.

J. Use the new survey information to make adjustments, if necessary, to the final grading plan for the proposed work. Changes to the final grading plan based on revised survey information shall be reviewed and approved by the Engineer.

K. Furnish and set control staking. Rough stakes may be used to denote top and bottom of slopes, edge of refuse, centerline of ditches, etc.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies the work to be performed by Contractor for abandonment of utilities at the Project Site. This Section includes:

1. Removal and abandonment of pipe, manholes, catch basins, conduit, duct bank, hand holes, wiring and pole bases, fixtures, poles.

2. Abandonment of above- and below-grade utilities and related facilities including but not necessarily limited to electric, tel-data, CATV, conduits, utility structures sewerage, grease traps, drainage, gas, and water, fire protection on, or serving the Project Area as shown on the Drawings or indicated herein.

B. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

C. Contractor is responsible for the health and safety of all Subcontractor workers during progress of the work.

D. All below grade utilities shall be removed, not abandoned, that are located below proposed building footprint, retaining walls, and all other areas below proposed structures.

1.2 SUBMITTALS

A. Abandonment procedures required by the owner of each utility prior to performing the work of utility termination/cutting/capping/plugging.

B. Material specifications and shop drawings for all materials and equipment furnished under this section, prior to performing the work of utility abandonment.

C. As-built drawings showing locations of all terminated/cut/capped/plugged utilities and service disconnections at or before project close-out.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with the material specifications required by the owner of each utility. Where such material specifications may conflict with this Specification, utility owner's requirements shall prevail.

B. Borrow Material: Conform to applicable Specifications.

C. Portland Cement: ASTM C 150, Type II.

D. Mortar Aggregate: ASTM C 144, standard masonry type, clean, dry, free of deleterious materials.

E. Concrete: Design of mix in accordance with ASTM C-94, ASTM C-150, Type II Portland Cement, washed and graded sand, and aggregate with maximum size of 1-inch; or pre-packaged concrete mix with maximum aggregate size of 1-inch, ASTM C 387. Minimum 28-day compressive strength of 4000 psi.

F. Masonry Mix: Washed and graded mason sand, lime, and Portland Cement, ASTM C 270; or pre-packaged, dry, sand/lime/cement mortar mixture, ASTM C 387. Minimum 28-day compressive strength of 1200 psi.

G. Water: Potable, free of deleterious materials.

H. Solid Concrete Masonry Unit: ASTM C55, sized per pipe diameter to minimize requirements for cutting.

PART 3 EXECUTION

3.1 GENERAL

A. Notify Call Before You Dig (CBYD) and obtain CBYD tracking number. Note, CBYD does not cover all of Camp Niantic, contractor is to hire a private utility marking company to perform utility locator services if needed.

B. Notify utility owners in reasonable advance of the work and request the utility owner to stake out on the ground surface the underground facilities and structures. Notify the Engineer and Agency Construction Coordinator in writing of any refusal or failure to stake out such underground utilities after reasonable notice.

C. Contractor is solely responsible for providing coordination and obtaining permits with owners of the various utilities serving, or present at, the Project Site as required to complete termination and demolition work. Coordinate as required for termination of service, temporary termination of service, relocation of facilities, abandonment of facilities, demolition of facilities, cutting, capping, and bracing. Comply at all times with the procedures for terminations of utility services as required by the owner of each utility serving, or present at, the Project Site.

D. When utilities are encountered that are not indicated on the drawings, notify Engineer and Agency Construction Coordinator before proceeding with work in such area.

3.2 UTILITY TERMINATION

A. Terminate utilities serving the Project Site as indicated on the Drawings. Terminate, cut, cap, or plug utilities in accordance with each utility owner's requirements, including, but not necessarily limited to, scheduling of inspections by utility company personnel, permits, licenses, approvals, insurance, or bonds.

3.3 DEMOLITION

A. Do not demolish any utility until termination has been verified.

B. Unless identified on the Drawings to remain, remove and dispose of all overhead and underground utilities and related systems and appurtenances on the Project Site, including but not necessarily limited to water, electric, sanitary sewer, storm sewer, miscellaneous drainage, heating facilities, communications, exterior lighting supplies; utility poles, light standards, utility foundations, supports and ancillary equipment; hydrants and other similar supply facilities, valves and meters; site drainage and catch basins and related structures; sanitary sewerage piping, manholes, pumps, and related facilities; and other miscellaneous plumbing, piping and conveyances.

3.4 BACKFILL

A. Replace soil material excavated for utility removal, termination or abandonment in accordance with applicable Specifications.

1. Backfilling to grade is required with Compacted Granular Fill.

2. Imported Compacted Granular Fill material is required.

B. Provide OSHA-compliant barriers or smooth edges of all excavations to produce a stable slope, with smooth grade transitions and no vertical cuts from top of slope to lower limits of the excavation in compliance with the requirements of OSHA. Maximum slope into any excavated area under ideal soil conditions shall be 1 to 1 ½, vertical : horizontal.

3.5 PROTECTION

A. Subcontractor shall take measures to protect from damage those utilities, or portions thereof, which are designated to remain. Provide protection as required such as marking, blocking, bracing, stabilizing, supporting, and retaining.

B. Utilities to remain damaged by Subcontractor shall be repaired/replaced to the satisfaction of the utility owner at Contractor's expense.

3.6 DOCUMENTATION

A. Contractor shall provide as-built documentation for each utility termination, including location, depth, and method and material of construction for termination. Such as-built documentation shall be on the appropriate site plans.

B. Contractor shall physically mark the location of each subsurface utility termination with a surveyor's stake, with such stake identifying the utility type and depth below grade. Where the use of stakes at a utility termination location may be inappropriate, Subcontractor shall provide staking at an adjacent location(s) and include appropriate offset dimensions or other suitable demarcation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Electrical equipment coordination and installation.

B. Sleeves for raceways and cables.

C. Sleeve seals.

D. Grout.

E. Common electrical installation requirements.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

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

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Section 08 31 00.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 13.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A53, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

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

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052-inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and one (1) or more sides equal to, or more than, 16 inches, thickness shall be 0.138-inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Stainless steel. Include two (2) for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one (1) for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

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

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

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

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

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

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

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

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

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

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

F. Extend sleeves installed in floors two (2) inches above finished floor level.

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

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 92 00.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Section 07 84 13.

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

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

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

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

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

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 07 84 13.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Building wires and cables rated 600 V and less.

B. Connectors, splices, and terminations rated 600 V and less.

1.3 RELATED REQUIREMENTS

A. Section 26 05 13 - Medium-Voltage Cables: Single-conductor and multi-conductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

B. Section 27 15 00 - Communications Horizontal Cabling: Cabling used for voice and data circuits.

1.4 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. General Cable; General Cable Corporation.
7. Senator Wire & Cable Company.
8. Service Wire Co.
9. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

D. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

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

1. 3M.
2. AFC Cable Systems, Inc.
3. Gardner Bender.
4. Hubbell Power Systems, Inc.
5. Ideal Industries, Inc.
6. ILSCO.
7. NSi Industries LLC.
8. O-Z/Gedney; a brand of Emerson Industrial Automation.
9. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 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 NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or metal-clad cable, Type MC steel jacket.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 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 26 05 33 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 26 05 29.

G. Complete cable tray systems installation according to Section 26 05 36 prior to installing conductors and cables.

3.4 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.

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 six (6) inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53.

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Grounding systems and equipment.

B. Grounding systems and equipment, plus the following special applications:

1. Overhead-line grounding.
2. Underground distribution grounding.

1.3 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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 in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16-inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16-inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two (2) bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression -type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4-inch by 10 feet in diameter.

PART 3 - EXECUTION

3.1 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 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers two (2) inches minimum from wall, six (6) inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections:

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

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install two (2) parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 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 four (4) inches 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 two (2) inches above to six (6) inches below concrete. Seal floor opening with waterproof, non-shrink 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 (2) 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 inches from the foundation.

3.4 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. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 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 two (2) inches 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.
2. For grounding electrode system, install at least three (3) rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43, and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one (1) test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one (1) of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four (4) locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.6 LABELING

A. Comply with requirements in Section 26 05 53 for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. 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. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two (2) 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.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

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

D. Prepare test and inspection reports.

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Hangers and supports for electrical equipment and systems.

B. Construction requirements for concrete bases.

1.3 RELATED SECTIONS

A. Section 26 05 48.16 - Seismic Controls for Electrical Systems: Products and installation requirements necessary for compliance with seismic criteria.

1.4 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.5 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.6 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For the following:

1. Steel slotted support systems.

C. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include product data for components.
2. Steel slotted channel systems. Include product data for components.
3. Nonmetallic slotted channel systems. Include product data for components.
4. Equipment supports.

1.7 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Welding certificates.

1.8 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. ERICO International Corporation.

d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Atkore International.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36, steel plates, shapes, and bars; black and galvanized.

F. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Cooper B-Line, Inc.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

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

B. Materials: Comply with requirements in Section 05 50 00 for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4-inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in 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 shall be weight of supported components plus 200 lb.

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. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than four (4) inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than four (4) inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Metal conduits, tubing, and fittings.

B. Nonmetal conduits, tubing, and fittings.

C. Metal wireways and auxiliary gutters.

D. Surface raceways.

E. Boxes, enclosures, and cabinets.

1.3 RELATED REQUIREMENTS

A. Section 26 05 43 - Underground Ducts and Raceways for Electrical Systems: Exterior ductbanks, manholes, and underground utility construction.

B. Section 27 05 28 - Pathways for Communications Systems: Conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

C. Section 28 05 28 - Pathways for Electronic Safety and Security: Conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.4 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.5 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.6 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

C. Qualification Data: For professional engineer.

D. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.

8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corporation.

6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; Hubbell.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Mono-Systems, Inc.

4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. [Manufacturer's standard enamel finish in color selected by Architect.

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

a. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

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

a. Hubbell Incorporated.
b. Mono-Systems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

D. Tele-Power Poles:

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

a. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

2. Material: Galvanized steel with ivory baked-enamel finish.
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.

4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

M. Gangable boxes are allowed.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-80-PVC concrete encased under roadway.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage (above 36 inches): EMT.
2. Exposed and Subject to Severe Physical Damage (below 36 inches): GRC. Raceway locations include the following:

   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Gymnasiums.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 degrees F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least six (6) inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 05 29 for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of four (4) 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Arrange raceways to keep a minimum of two (2) inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. 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 trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two (2) supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel

box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. 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 the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 degrees F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 degrees F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 degrees F temperature change.
   d. Attics: 135 degrees F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per degrees F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078-inch per foot of length of straight run per degrees F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires**,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

X. 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.

Y. 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.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three (3) gangs or more from more than one (1) side by spanning two (2) framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 for pipe less than six (6) inches in nominal diameter.
2. Install backfill as specified in Section 31 20 00.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with three (3) inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a

minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 26 05 53.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

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

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Direct-buried conduit, ducts, and duct accessories.

B. Concrete-encased conduit, ducts, and duct accessories.

C. Handholes and boxes.

D. Manholes.

1.3 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes**,** and other utility structures.
4. Include warning tape.

C. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole frame support rings.
e. Include ladder details.
f. Include grounding details.

g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
h. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

C. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C858.

D. Qualification Data: For professional engineer and testing agency responsible for testing non-concrete handholes and boxes.

E. Source quality-control reports.

F. Field quality-control reports.

1.6 MAINTENANCE MATERIALS SUBMITTALS

A. Submit under provisions of Section 01 33 00.

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

C. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to five (5) percent of quantity of each item installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.8 FIELD CONDITIONS

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 Architect, Project Manager and Agency Construction Coordinator no fewer than two (2) days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

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

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corporation.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Section 26 05 53.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

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

1. Christy Concrete Products.
2. Elmhurst-Chicago Stone Co.
3. Oldcastle Precast Group.
4. Rinker Group, Ltd.
5. Riverton Concrete Products.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile Inc.

B. Comply with ASTM C858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

2. Coordinate remaining subparagraphs below with Drawings.

3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

4. Cover Legend: Molded lettering, as indicated for each service.

5. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

6. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

a. Extension shall provide increased depth of 12 inches.
b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

7. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

8. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

   a. Windows shall be located no less than six (6) inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
   b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
   c. Window openings shall be framed with at least two (2) additional No. 3 steel reinforcing bars in concrete around each opening.

9. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

10. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" article.

1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, as indicated for each service.

6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two (2).

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

a. Armorcast Products Company.
b. Carson Industries LLC.
c. NewBasis.
d. Quazite: Hubbell Power System, Inc.

2.6 PRECAST MANHOLES

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

1. Christy Concrete Products.
2. Elmhurst-Chicago Stone Co.
3. Oldcastle Precast Group.
4. Rinker Group, Ltd.
5. Riverton Concrete Products.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile Inc.

B. Comply with ASTM C858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" article.

D. Precast Manholes: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

2. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

3. Window openings shall be framed with at least two (2) additional No. 3 steel reinforcing bars in concrete around each opening.

F. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct or conduit to be terminated.
2. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

G. Concrete Knockout Panels: 1-1/2 to two (2) inches thick, for future conduit entrance and sleeve for ground rod.

H. Ground Rod Sleeve: Provide a 3-inch PVC conduit sleeve in manhole floors two (2) inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.7 UTILITY STRUCTURE ACCESSORIES

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

1. Bilco Company (The).
2. Campbell Foundry Company.
3. Christy Concrete Products.
4. East Jordan Iron Works, Inc.
5. Elmhurst-Chicago Stone Co.
6. McKinley Iron Works, Inc.
7. Neenah Foundry Company.
8. NewBasis.
9. Oldcastle Precast Group.
10. Osburn Associates, Inc.
11. Pennsylvania Insert Corporation.
12. Quazite:Hubbell Power Systems, Inc.
13. Rinker Group, Ltd.
14. Riverton Concrete Products.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile Inc.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48, Class 30B with milled cover-to-frame bearing surfaces; diameter, 26 inches.

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu ft where packaged mix complying with ASTM C387, Type M, may be used.
b. Seal joints watertight using preformed plastic or rubber conforming to ASTM C990. Install sealing material according to the sealant manufacturers' printed instructions.

C. Manhole Sump Frame and Grate: ASTM A48, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch diameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch diameter eye, rated 2500-lbf minimum tension.

F. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

H. Ground Rod Sleeve: 3-inch, PVC conduit sleeve in manhole floors two (2) inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

2. Arms: 1-1/2 inches wide, lengths ranging from three (3) inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.

3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 degrees F. Capable of withstanding temperature of 300 degrees F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Fixed Manhole Ladders: Arranged for attachment to roof or wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.

M. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches. One (1) required.

N. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two (2) required.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C1037.

B. Non-concrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 31 10 00. Remove and stockpile topsoil for reapplication according to Section 31 10 00.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables More than 600 V: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

D. Underground Ducts Crossing Paved Paths, Walks and Driveways and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.

4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

5. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 31 20 00, but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 32 92 00 and Section 32 93 00.

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" article in Section 01 73 00.

3.5 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two (2) manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 degrees C. Where environmental temperatures are calculated to rise above 40 degrees C, and anywhere the duct bank

crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4-inch.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 26 05 44.

H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

I. Pulling Cord: Install 100-lbf test nylon cord in empty ducts.

J. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 31 20 00 for pipes less than six (6) inches in nominal diameter.

2. Width: Excavate trench three (3) inches wider than duct bank on each side.

3. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.

4. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

5. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four (4) spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately six (6) inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

6. Minimum Space between Ducts: Three (3) inches between ducts and exterior envelope wall, two (2) inches between ducts for like services, and four (4) inches between power and signal ducts.

7. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with three (3) inches of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

8. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

10. Concrete Cover: Install a minimum of three (3) inches of concrete cover at top and bottom, and a minimum of two (2) inches on each side of duct bank.

11. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one (1) continuous operation.

    a. Start at one (1) end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one (1) pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

12. Pouring Concrete: Comply with requirements in "Concrete Placement" article in Section 03 30 00. Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

K. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 31 20 00 for preparation of trench bottoms for pipes less than six (6) inches in nominal diameter.

2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

3. Space separators close enough to prevent sagging and deforming of ducts, with not less than four (4) spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately six (6) inches between tiers.

4. Depth: Install top of duct bank at least 36 inches below finished grade unless otherwise indicated.

5. Set elevation of bottom of duct bank below frost line.

6. Install ducts with a minimum of three (3) inches between ducts for like services and six (6) inches between power and signal ducts.

7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with three (3) inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 31 20 00 for installation of backfill materials.

    a. Place minimum three (3) inches of sand as a bed for duct bank. Place sand to a minimum of six (6) inches above top level of duct bank.
    b. Place minimum six (6) inches of engineered fill above concrete encasement of duct bank.

L. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within three (3) inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C891 unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames one (1) inch above finished grade.
3. Install handholes with bottom below frost line.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes one (1) inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three (3) days. Waterproofing materials and installation are specified in Section 07 13 53. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three (3) days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and two (2) inches for handholes, for anchor bolts installed in the field. Use a minimum of two (2) anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes one (1) inch above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, non-deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Section 03 30 00, with a troweled finish.

2. Dimensions: 10 inches wide by 12 inches deep.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 05 26.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Isolation pads.

B. Spring isolators.

C. Restrained spring isolators.

D. Channel support systems.

E. Restraint cables.

F. Hanger rod stiffeners.

G. Anchorage bushings and washers.

1.3 RELATED SECTIONS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems: Commonly used electrical supports and installation requirements.

1.4 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. As indicated on the drawings.

1.6 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
   b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.

   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.7 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

C. Qualification Data: For professional engineer and testing agency.

D. Welding certificates.

E. Field quality-control test reports.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.

3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

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

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four (4) times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one (1) end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two (2) clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E488. Minimum length of eight (8) times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125-inch.

3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one (1) supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

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

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four (4) of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Identification for raceways.

B. Identification of power and control cables.

C. Identification for conductors.

D. Underground-line warning tape.

E. Warning labels and signs.

F. Instruction signs.

G. Equipment identification labels, including arc-flash warning labels.

H. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

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 degrees F, ambient; 180 degrees F, material surfaces.

2.2 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.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. 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."

2.3 LABELS

A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: 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, provide products by one (1) of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. LEM Products Inc.
f. Marking Services, Inc.
g. Panduit Corp.
h. Seton Identification Products.

B. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.

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

a. Brady Corporation.
b. Marking Services, Inc.
c. Panduit Corp.
d. Seton Identification Products.

C. Self-Adhesive Labels:

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

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Preprinted, 3-mil thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable and/or raceway diameter, such that the clear shield overlaps the entire printed legend.

3. **Vinyl t**hermal, transfer-printed, 3-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

a. Nominal Size: 3.5-by-5-inch.

4. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 BANDS AND TUBES:

A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, two (2) inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

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

a. Brady Corporation.
b. Marking Services, Inc.
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 cables they identify. Full shrink recovery occurs at a maximum of 200 degrees F. Comply with UL 224.

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

a. Brady Corporation.
b. Panduit Corp.

2.5 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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

a. Carlton Industries, LP.
b. Champion America.
c. Ideal Industries, Inc.
d. Marking Services, Inc.
e. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than three (3) mils thick by 1 to 2 inches wide; compounded for outdoor use.

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

a. Brady Corporation.
b. Carlton Industries, LP.

c. emedco.
d. Marking Services, Inc.

C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

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

a. LEM Products Inc.
b. Marking Services, Inc.
c. Seton Identification Products.

D. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

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

a. Carlton Industries, LP.
b. Seton Identification Products.

E. Underground-Line Warning Tape:

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

a. Brady Corporation.
b. Ideal Industries, Inc.
c. LEM Products Inc.
d. Marking Services, Inc.
e. Reef Industries, Inc.
f. Seton Identification Products.

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".

4. Tag: Type ID:

a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one (1) side with the inscription of the utility, compounded for direct-burial service.
b. Width: Three (3) inches.
c. Overall Thickness: Five (5) mils.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 28 lb/1000 sq ft.
f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

F. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be one (1) inch.

2.6 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Carlton Industries, LP.
b. Champion America.
c. emedco.
d. Marking Services, Inc.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized steel backing and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.
4. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq inches, minimum 1/16-inch.
b. For signs larger than 20 sq inches, 1/8-inch thick.
c. Engraved legend with black letters on white face.
d. Punched or drilled for mechanical fasteners.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

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

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.

2.7 CABLE TIES

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

1. Ideal Industries, Inc.
2. Marking Services, Inc.
3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one (1) piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73 degrees F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 degrees F.
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 (1) piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73 degrees F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 degrees F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one (1) piece, self-locking.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73 degrees F according to ASTM D638: 7000 psi.

3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 degrees F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

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. 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.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting sections for surface preparation and paint application.

J. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

L. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at six (6) to eight (8) inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high black letters on 20-inch centers. Stop stripes at legends. Apply stripes to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.

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 label. Install labels at 10-foot maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of six (6) inches from terminal points and in boxes where splices or taps are made. Apply last two (2) turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

G. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl label**s** with the conductor or cable designation, origin, and destination.

I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.

J. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

K. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

L. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

M. Workspace Indication: Install floor marking tape to 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.

N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

   a. Power-transfer switches.
   b. Controls with external control power connections.

O. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.
2. Comply with Section 26 05 74 requirements for arc-flash warning labels.

P. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

Q. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.

R. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two (2) lines of text are required, use labels two (2) inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Emergency system boxes and enclosures.
    h. Enclosed switches.
    i. Enclosed circuit breakers.
    j. Enclosed controllers.
    k. Power-transfer equipment.
    l. Contactors.
    m. Power-generating units.
    n. Monitoring and control equipment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Dry-type, medium-voltage transformers, with primary and secondary bushings within or without air-terminal enclosures.

1.3 DEFINITIONS

A. BAS: Building Automation System.

B. BIL: Basic Impulse Insulation Level.

C. VPE: Vacuum Pressure Encapsulation.

D. VPI: Vacuum Pressure Impregnation.

1.4 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

C. Shop Drawings: For dry-type, medium-voltage transformers.

1. Include plans and elevations showing major components and features.

a. Include a plan view and cross section of equipment base, showing clearances, manufacturer's recommended workspace, and locations of penetrations for grounding and conduits.

2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include single-line diagram.
4. Include list of materials.
5. Include nameplate legends.

1.5 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Coordination Drawing:

1. Location plan, showing heavy equipment or truck access paths for maintenance and replacement.
2. Dimensioned concrete base, outline of transformer, conduit entries, and grounding equipment locations.
3. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways, cable trays, busways, and seismic anchors.
4. Location of lighting fixtures, sprinkler piping and heads, ducts, and diffusers.

C. Qualification Data: For testing agency.

D. Seismic Qualification Certificates: For transformer assembly, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For transformers, signed by product manufacturer.

F. Source quality-control reports.

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Industries, Inc.
2. Eaton Electrical Sector; Eaton Corporation.
3. General Electric Company.
4. Hammond Power Solutions Inc.
5. Siemens Energy.
6. Square D; by Schneider Electric.

2.2 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 IEEE C2.

C. Comply with IEEE C57.12.01.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: The transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

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

B. Windings Material: Aluminum.

C. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, connected in each phase of incoming circuit and ahead of any disconnecting device.

D. Cooling Systems: Comply with IEEE C57.12.01 for cooling class.

E. Coils Insulation Systems:

1. Primary and secondary coil assemblies shall be manufactured using silicone resin VPE system.

F. Winding Connections: Connection of windings and terminal markings shall comply with IEEE C57.12.70.

G. Efficiency: Comply with 10 CFR 431, Subpart K.

H. Bushings shall comply with IEEE C57.19.01 requirements for impulse and low-frequency insulation levels.

I. Tap Changer: External, for de-energized operation.

J. Enclosure:

1. Provide with provisions for lifting and anchoring frame to concrete pad.
2. With an integral skid-mounting frame, suitable to allow skidding or rolling of transformer in any direction.
3. Outdoor Transformer Enclosure Finish: Factory-applied finish in manufacturer's standard color, corrosion resistant complying with IEEE C57.12.28.
4. Taps: Two (2) 2-1/2-percent, full-capacity taps above and two (2) 2-1/2-percent, full-capacity taps below rated voltage. Comply with IEEE C57.12.36 requirements.

K. Sound level shall comply with requirements of NEMA TR 1.

L. Capacities and Characteristics:

1. Enclosure: Non-ventilated power transformer, NEMA 250 Type 3R enclosure.
2. Comply with UL 1562 listing requirements.
3. Service Conditions: The transformers shall be suitable for operation under service conditions specified as usual service conditions in IEEE C57.12.01, except for the following:

    a. Altitudes above 3,300 feet.
    b. Cooling air or water temperature exceeds limits.
    c. Excessive load current harmonic factor.
    d. Operation above rated voltage or below rated frequency.
    e. Exposure to explosive environments.
    f. Exposure to fumes, vapors, or dust.
    g. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
    h. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
    i. Exposure to excessively high or low temperatures.
    j. Unusual transportation or storage conditions.
    k. Unusual grounding resistance conditions.
    l. Unusual space limitations.

4. Connections:

    a. Primary: Air-filled terminal cabinet for cable connection.
    b. Secondary: Air-filled terminal cabinet for cable connection.

5. Transformer Ratings.

    a. Impedance: Not less than 5.75 percent.
    b. Temperature Rise: 150 degrees C.

c. Coils Connection:

1) High-Voltage Winding: Delta.
2) Low-Voltage Winding: Wye.

d. Voltage and BIL Ratings:

1) Nominal primary phase-to-phase voltage and BIL: As noted on the drawings.
2) Nominal secondary voltage and BIL: As noted on the drawings.

6. Taps: Two (2) 2-1/2-percent, full-capacity taps above and two (2) 2-1/2-percent, full-capacity taps below rated voltage. Comply with IEEE C57.12.51 requirements.
7. Transformer Accessories:

a. Dial-type analog thermometer with alarm contacts.
b. At least four (4) stainless steel ground connection pads.
c. Provisions for jacking, lifting, and towing.
d. Machine-engraved nameplate made of anodized aluminum or stainless steel.

2.4 CONTROL NETWORK

A. Controllers: Support serial MS/TP and Ethernet IP communications, and able to communicate directly via RS-485 serial networks and Ethernet 10Base-T networks as a native device.

2.5 WARNING LABELS AND SIGNS

A. Comply with requirements for labels and signs specified in Section 26 05 53.

1. Warning signs shall be made of baked enamel.
2. Equipment Identification Labels: Engraved, laminated-acrylic or -melamine label.

2.6 SOURCE QUALITY CONTROL

A. Provide manufacturer's certificate that the transformer design tests comply with IEEE C57.12.91.

B. Perform the following factory-certified routine tests on each transformer 500 kVA and less for this project:

1. Turns ratio, polarity, and phase relation on rated voltage connection.
2. Transformer no-load losses and excitation current at 100 percent of ratings. This test may be based on a statistical sample.
3. Applied voltage and induced voltage.
4. Partial discharge.

5. Impedance voltage and load loss at rated current and rated frequency on rated voltage connection and at tap extremes.
6. Temperature rise at minimum and maximum ratings.
7. Impulse.
8. Insulation power factor.
9. Insulation resistance.
10. Audible sound level.
11. Short-circuit capability.
12. Operation of all devices.
13. Control (auxiliary) and consumption loss data values.

C. Perform the following factory-certified tests on each transformer 500 kVA and larger for this project. Reports shall comply with the minimum information requirements of IEEE C57.12.01:

1. Resistance measurements of all windings on rated voltage tap and at tap extremes.
2. Turns ratio, polarity, and phase relation on rated voltage connection.
3. Transformer no-load losses and excitation current at 100 percent of ratings.
4. Impedance voltage and load loss at rated current and rated frequency on rated voltage connection and at tap extremes.
5. Applied voltage and induced voltage.
6. Partial discharge.
7. Leak test.
8. Temperature rise at minimum and maximum ratings.
9. Impulse.
10. Insulation power factor.
11. Insulation resistance.
12. Audible sound level.
13. Short-circuit capability.
14. Operation of all devices.
15. Control (auxiliary) and consumption loss data values.

D. Owner will witness required factory tests. Notify Architect at least 14 days before date of tests and indicate their approximate duration.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine dry-type, medium-voltage transformers upon delivery.

1. Upon delivery of transformers and prior to unloading, inspect equipment for any damage that may have occurred during shipment or storage.
2. Verify that tie rods and chains are undamaged and tight, and that all blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.

3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
4. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform to manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with project requirements, notify manufacturer in writing immediately.
5. Unload transformers carefully, observing all packing label warnings and handling instructions.
6. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and transformer case.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use all lifting lugs when lifting transformers.
6. Use jacks only at corners of base plate of transformer case.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with a crane.
8. Use spreaders or a lifting beam to obtain a vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage base structure of case when handling transformer using skids or rollers. Use skids to distribute stresses over case base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three (3) months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting any discrepancies or adverse conditions. Visually check for rust spots.

D. Examine areas and space conditions for compliance with requirements for dry-type, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

F. Examine walls, floors, roofs, and concrete bases for suitable conditions for transformer installation.

G. Pre-Installation Checks:

1. Verify removal of any shipping bracing after placement.

H. Verify that ground connections are in place and that requirements in Section 26 05 26 have been met. Maximum ground resistance shall be 5 ohms at transformer location.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00.

B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized.

C. Comply with requirements for vibration isolation and seismic control devices specified in Section 26 05 29 and Section 26 05 48.16.

D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26.
1. At Exterior Locations:

a. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches below grade interconnecting grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors. Keep lead lengths as short as practicable, with no kinks or sharp bends.
b. Fence and equipment connections shall not be smaller than No. 4 AWG. Ground fence at each gate post and corner post and at intervals not

exceeding 10 ft. Bond each gate section to fence post using 1/8 by 1 inch tinned flexible braided copper strap and clamps.

c. Make joints in grounding conductors and loops by exothermic weld or compression connector.

2. Terminate all grounding and bonding conductors on a common equipment grounding terminal on transformer enclosure. Install supplemental terminal bars, lugs, and bonding jumpers as required to accommodate number of conductors for termination.
3. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.

B. Connect wiring according to Section 26 05 19.

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

C. Terminate medium-voltage cables in incoming section of substations according to Section 26 05 13.

3.4 SIGNS AND LABELS

A. Comply with installation requirements for labels and signs specified in Section 26 05 53.

B. Install warning signs as required to comply with 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. General Field-Testing Requirements:

a. Comply with provisions of NFPA 70B, Ch. "Testing and Test Methods."
b. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
c. After installing transformer but before primary is energized, verify that grounding system at substation is tested at specified value or less.

d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
e. Visual and Mechanical Inspection:

1) Verify equipment nameplate data complies with Contract Documents.
2) Inspect bolted electrical connections for high resistance using one (1) of the following two (2) methods:

a) Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.

f. Remove and replace malfunctioning units and retest.
g. Prepare test and inspection reports. Record as-left set points of all adjustable devices.

2. Medium-Voltage Surge Arrester Field Tests:

a. Visual and Mechanical Inspection:

1) Inspect physical and mechanical condition.
2) Inspect anchorage, alignment, grounding, and clearances.
3) Verify arresters are clean.
4) Verify that ground lead on each device is individually attached to a ground bus or ground electrode.
5) Verify that stroke counter is correctly mounted and electrically connected if applicable. Record stroke counter reading.

b. Electrical Test:

1) Perform an insulation-resistance test on each arrester, phase terminal-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to meet recommended minimum insulation resistance listed in that table.
2) Perform a watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.

3. Dry-Type Transformer Field Tests:

a. Visual and Mechanical Inspection:

1) Test dew point of tank gases if applicable.
2) Inspect anchorage, alignment, and grounding.

3) Verify that resilient mounts are free and that any shipping brackets have been removed.
4) Verify bushings are clean.
5) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
6) Verify that cooling fans operate correctly and have appropriate overcurrent protection.
7) Perform specific inspections and mechanical tests recommended by manufacturer.
8) Verify that as-left tap connections are as specified.

b. Electrical Tests:

1) 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.
2) Perform power-factor or dissipation-factor tests on all windings according to test equipment manufacturer's published data.
3) Perform a power-factor or dissipation-factor tip-up test on windings greater than 2.5 kV.
4) Perform turns-ratio tests at tap positions. Turns-ratio test results shall not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
5) Perform an excitation-current test on each phase. The typical excitation-current test data pattern for a three-legged core transformer is two (2) similar current readings and one (1) lower current reading. Investigate and correct if test shows a different pattern.
6) Measure resistance of each winding at each tap connection, and record temperature-corrected winding-resistance values in Operations and Maintenance Manual.
7) Perform an applied-voltage test on high- and low-voltage windings-to-ground. Comply with IEEE C57.12.91 provisions for field-deployed dielectric teats. Measurements shall be made only when voltage and current have reached a stable value. Test shall be discontinued immediately in the event the current begins to increase without stabilizing. Record test values in Operations and Maintenance Manual.
8) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

3.6 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Military Department, but not more than six (6) months after Final Acceptance, perform the following voltage monitoring:

1. During a period of normal load cycles as evaluated by Military Department, perform seven (7) days of three-phase voltage recording at the outgoing section of each transformer. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than one (1) inch per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus five (5) percent during test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:

    a. Adjust transformer taps.
    b. Prepare written request for voltage adjustment by electric utility.

3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Report:

    a. Prepare a written report covering monitoring performed and corrective action taken.

B. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove all necessary covers prior to inspection.

1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections.
2. Instrument: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 degree C at 30 degrees C.
3. Record of Infrared Inspection: Prepare a certified report that identifies testing technician and equipment used, and lists results as follows:

    a. Description of equipment to be tested.
    b. Discrepancies.
    c. Temperature difference between area of concern and reference area.
    d. Probable cause of temperature difference.
    e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
    f. Identify load conditions at time of inspection.
    g. Provide photographs and thermograms of deficient area.

4. Act on inspection results according to recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Military Department's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Fusible switches.

B. Non-fusible switches.

C. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers 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 from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

C. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Qualification Data: For qualified testing agency.

C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Submit under provisions of Section 01 33 00.

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

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three (3) of each size and type.
2. Fuse Pullers: Two (2) for each size and type.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 degrees F and not exceeding 104 degrees F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Military Department or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Project Manager and Agency Construction Coordinator no fewer than two (2) days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Military Department's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, [240] [600]-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate [specified] [indicated] fuses, lockable handle with capability to accept three (3) padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.2 NON-FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, [240] [600]-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Hookstick Handle: Allows use of a hookstick to operate the handle.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down] Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, [Type 4] [Insert type].
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48.16.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, 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 stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. CT Technical Guide for Installation Information Infrastructure Architecture, August 2011.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. 62.5/125 micrometer, OM3, optical fiber cabling.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

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

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between Tele-communications equipment rooms, main terminal spaces and entrance facility rooms for the voice/data/video video cabling systems.

B. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patching or jumpers used for backbone-to-backbone cross-connection to service provider equipment.

C. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

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

1.6 SUBMITTALS

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

1. For coaxial cable, include the following installation data for each type used:

   a. Nominal OD.
   b. Minimum bending radius.
   c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:

   a. Cross-connects.
   b. Patch panels.
   c. Patch cords.

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

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

D. Source quality-control reports.

E. Field quality-control reports.

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

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

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

1. Layout Responsibility: Preparation of Shop Drawings and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

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

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

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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

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

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector,

including the loss value of each. Retain test data and include the record in maintenance data.

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

1.9 PROJECT CONDITIONS

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

1.10 COORDINATION

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

PART 2 - PRODUCTS

2.1 PATHWAYS

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

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

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

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

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 UTP CABLE

A. Description: Voice Backbone Cabling.

B. Cable shall be 100-ohm, 25-pair UTP, plenum rated cable, with solid un-tinned copper, 24 AWG conductors.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.

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

1. Mohawk
2. Berk-Tek
3. General
4. Belden

2.3 UTP CABLE HARDWARE

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

1. Mohawk
2. Berk-Tek
3. General
4. Siemon

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

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

D. 100 Pair 110 Style CAT 6 19” rack mounted patch panels to allow for cross-connection from voice origination (PBX) to workstations via CAT 6 patch cords.

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

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

F. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.

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

2.4 OPTICAL FIBER CABLE

A. Description: Data Backbone Cabling.

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

1. Mohawk
2. Berk-Tek
3. General
4. Belden

C. Description: OM3, Single-mode, 62.5/125, 24-fiber, nonconductive, tight buffer, armored optical, plenum rated, fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
4. Maximum Attenuation, Conform to EIA/TIA-455-61: 2.50 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
5. Minimum Modal Bandwidth, Conform to EIA/TIA-455-204: 1500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

D. Jacket:

1. Jacket Color: Orange.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.5 OPTICAL FIBER CABLE HARDWARE

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

1. Leviton
2. Berk-Tek
3. Hubbell
4. Siemon

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.6 CATV COAXIAL CABLE

A. Series 11, 14 AWG solid 0.064 bare copper-covered steel conductor, gas-injected foam polyethylene insulation, Duobond® II + aluminum braid shield (60% coverage), PVC jacket.

1. Conductor:
   a. Number of Coax: 1
   b. Total Number of Conductors: 1
   c. Series Type: Series 11
   d. AWG: 14
   e. Stranding: Solid
   f. Conductor Diameter: 0.064 inch
   g. Conductor Material: BCCS – Bare Copper Covered Steel
2. Insulation:
   a. Insulation Material: Gas-injected FPE – Foam Polyethylene
   b. Insulation Diameter: 0.280 inch
3. Outer Shield:
   a. Outer Shield Material Trade Name: Duobond® II
   b. Outer Shield Type: Tape/Braid
4. Outer Shield Material:
   a. Layer 1: Duobond®, Tape, 100% coverage
   b. Layer 2: Aluminum Braid, 60% coverage
5. Outer Jacket Material: PVC – Polyvinyl Chloride
6. Overall Nominal Diameter: 0.400 inch
7. Electrical Characteristics:
   a. Nominal Characteristic Impedance: 75Ω
   b. Nominal Inductance: 0.097 µH/ft
   c. Nominal Velocity of Propagation: 83%
   d. Nominal Delay: 1.2 ns/ft
   e. Nominal Conductor DC Resistance @ 20 Deg. C: 11.0 Ω/1000 ft
   f. Nominal Outer Shield DC Resistance @ 20 Deg. C: 4.1 Ω/1000 ft

2.7 IDENTIFICATION PRODUCTS

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

2.8 SOURCE QUALITY CONTROL

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

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

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

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

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

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and J-hooks except where cable trays are required in Drawings. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

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

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

3.3 INSTALLATION OF PATHWAYS

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

B. Drawings indicate general arrangement of pathways and fittings.

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

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

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

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

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

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot long service loop on each end of cable.

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

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

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

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

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

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

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

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

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

3.6 GROUNDING

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

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

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

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

3.7 IDENTIFICATION

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

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

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

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

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

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

   a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.

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

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

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

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

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

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

4. Optical Fiber Cable Tests:

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

        1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
        2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

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

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

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

F. Prepare test and inspection reports

END OF SECTION 27 13 00

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Excavation, backfill and compaction for roadway section and other structures

2. Excavation, backfill and compaction for subsurface drainage structures and utilities

3. Earth retention systems

4. Excavation, backfill and compaction for the abandonment of existing pipe

5. Temporary dewatering systems

B. Related Sections

1. Section 31 2300, Borrow Materials

2. Section 32 1216, Bituminous Concrete Pavement

1.2 REFERENCES

A. ASTM D1557-07 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

B. ASTM D1556-07 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

C. ASTM D2487-06e1 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D. ASTM D6938-08a - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E. 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.650 through 1926.652 including Appendices A through F

1.3 DEFINITIONS

A. Benching - A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

B. Earth Retention Systems - Any structural system, such as sheeting and bracing or cofferdams, designed to retain in-situ soils in place and prevent the collapse of the sides of an excavation in order to protect employees and adjacent structures.

C. Excavation - Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

D. Protective System - A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include earth retention systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

E. Registered Professional Engineer - A person who is registered as a professional engineer in the State of Connecticut. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

F. Shield System - A structure that is designed to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

G. Sloping - A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

H. Temporary Dewatering System – A system to lower and control water to maintain stable, undisturbed subgrades at the lowest excavation levels. Dewatering shall be provided for all pipelines, structures and for all other miscellaneous excavations.

I. Trench - A narrow excavation (in relation to its length) made below the surface of the ground, of at least three feet in depth. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m).

1.4 SUBMITTALS

A. Drawings and calculations for each Earth Retention System required in the Work. The submittal shall be in sufficient detail to disclose the method of operation for each of the various stages of construction required for the completion of the Earth Retention Systems.

1. Submit calculations and drawings for Earth Retention Systems prepared, signed and stamped by a Professional Engineer registered in the State of Connecticut.

B. Performance data for the compaction equipment to be utilized

C. Construction methods that will be utilized for the removal of rock

D. Modified Proctor Test (ASTM D1557) results and soil classification (ASTM D2487) for all proposed backfill materials at the frequency specified below:

1. For suitable soil materials removed during Trench Excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the Engineer.

2. For borrow materials; perform tests at frequency specified in Section 312300, Borrow Materials.

E. Compaction test results (i.e. ASTM D6938 or ASTM D1556) at a frequency of one test for every 100 cubic yards of material backfilled or at a minimum of one test per lift. The Engineer will determine the locations and lifts to be tested.

1. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.

2. If all compaction test results within the initial 25% of the total anticipated number of tests indicate compacted field densities equal to or greater than the project requirements, the Engineer may reduce frequency of compaction testing. In no case will the frequency be reduced to less than one test for every 500 cubic yards of material backfilled.

3. The Contractor is cautioned that compaction testing by nuclear methods may not be effective where trenches are so narrow that trench walls impact the attenuation of the gamma radiation, when adjacent to concrete that impacts the accuracy of determining moisture content, or where oversize particles (i.e. large cobbles or coarse gravels) are present. In these cases, other field density testing methods may be required.

1.5 QUALITY ASSURANCE

A. All Excavation, Trenching, and related Earth Retention Systems shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P), and other State and local requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

B. The following test procedures will be performed by the Contractor's inspection agency. Results will be submitted to the Engineer for review.

1. Modified Proctor Test (ASTM D1557) results and soil classification (ASTM D2487) for all proposed backfill materials at the frequency specified below:

   a. For suitable soil materials removed during excavation, perform one test for every 1,000 cubic yards of similar soil type. Similarity of soil types will be as determined by the Engineer.

   b. For borrow materials; perform tests at frequency specified in Section 31 2300- Borrow Materials.

2. Compaction test results (i.e. ASTM D6938 or ASTM D1556) at a frequency of one test for every 100 cubic yards of material backfilled. The Engineer will determine the locations and lifts to be tested.

   a. The Engineer may specify additional compaction testing when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.

   b. If all compaction test results within the initial 25% of the total anticipated number of tests indicate compacted field densities equal to or greater than 95% of maximum dry density at optimum moisture content, the Engineer may reduce frequency of compaction testing. In no case will the frequency be reduced to less than one test for every 500 cubic yards of material backfilled.

   c. The Contractor is cautioned that compaction testing by nuclear methods may not be effective where excavation sidewalls impact the attenuation of the gamma radiation or where oversize particles (i.e. large cobbles or coarse gravels) are present. In these cases, other field density testing methods may be required.

1.6 PROJECT CONDITIONS

A. Notify Call Before You Dig, 48 hours prior to any excavation operations. See Field Engineering 01 72 10, for note concerning private utility locator services.

B. Notify utility owners in reasonable advance of the work and request the utility owner to stake out on the ground surface the underground facilities and structures. Notify the Engineer and Agency Construction Coordinator in writing of any refusal or failure to stake out such underground utilities after reasonable notice.

C. Make explorations and Excavations to determine the location of existing underground structures, pipes, house connection services, and other underground facilities in accordance with Paragraph 3.2.D of this Section.

D. No person shall, except in an emergency, make an excavation in any public way, public property, or privately owned land until a permit is obtained from the appropriate designated permitting authority.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Fill material is subject to the approval of the Engineer and Agency Construction Coordinator and may be either material removed from excavations or borrow from off site. Fill material, whether from the excavations or from borrow, shall be of such nature that after it has been placed and properly compacted, it will make a dense, stable fill.

B. Satisfactory fill materials shall include materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, SW, and SP.

C. Satisfactory fill materials shall not contain trash, refuse, vegetation, masses of roots, individual roots more than 18 inches long or more than 1/2 inch in diameter, or stones over 6 inches in diameter. Unless otherwise stated in the Contract Documents, organic matter shall not exceed minor quantities and shall be well distributed.

D. Satisfactory fill materials shall not contain frozen materials nor shall backfill be placed on frozen material.

Excavated surface and/or pavement materials such as gravel or trap rock that are salvaged may be used as a sub-grade material, if processed to the required gradation and compacted to the required degree of compaction. In no case shall salvaged materials be substituted for the required gravel base.

2.2 DEWATERING MATERIALS

A. Provide haybales and silt fence in accordance with Section 312500.

B. Provide silt filter bags (Dandy Dewatering Bag, Dirtbag, JMP Environ-Protection Filter Bag, or equal) of adequate size to match flow rate.

PART 3 EXECUTION

3.1 PREPARATION

A. Public Safety and Convenience

1. Adhere to the requirements of State of Connecticut regulations for all excavation work.
2. Take precautions for preventing injuries to persons or damage to property in or about the Work.
3. Provide safe access for the Owner's and Engineer's representatives at site during construction.
4. Do not obstruct site drainage, natural watercourses or other provisions made for drainage.

3.2 CONSTRUCTION

A. Earth Retention Systems

1. Provide Earth Retention Systems necessary for safety of personnel and protection of the Work, adjacent work, utilities and structures.
2. Maintain Earth Retention Systems for the duration of the Work.
3. Systems shall be constructed using interlocking corner pieces at the four corners. Running sheet piles by at the corners, in lieu of fabricated corner pieces, will not be allowed.
4. Drive sheeting ahead of and below the advancing trench excavation to avoid loss of materials from below and from in front of the sheeting.
5. Sheeting is to be driven to at least the depth specified by the designer of the earth retention system, but no less than 2 feet below the bottom of the Excavation.

6. Remove sheeting, unless designated to be left in place, in a manner that will not endanger the construction or other structures. Backfill and properly compact all voids left or caused by the withdrawal of sheeting.

7. Remove earth retention systems, which have been designated by the Engineer to be left in place, to a depth of 3 feet below the established grade.

B. Excavation

1. Perform excavation to the lines and grades indicated on the Drawings. Backfill unauthorized over-excavation in accordance with the provisions of this Section, at no additional cost to the State.

2. Excavate with equipment selected to minimize damage to existing utilities or other facilities. Hand excavate as necessary to locate utilities or avoid damage.

3. Sawcut the existing pavement in the vicinity of the excavation prior to the start of excavation in paved areas, so as to prevent damage to the paving outside the requirements of construction.

4. During excavation, material satisfactory for backfill shall be stockpiled in an orderly manner at a distance from the sides of the excavation equal to at least one half the depth of the excavation, but in no case closer than 2 feet.

   a. Excavated material not required or not suitable for backfill shall be removed from the site.

   b. Perform grading to prevent surface water from flowing into the excavation.

   c. Pile excavated material in a manner that will endanger neither the safety of personnel in the trench nor the Work itself. Avoid obstructing sidewalks and driveways.

   d. Hydrants under pressure, valve pit covers, valve boxes, manholes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the Work is completed.

5. Make pipe trenches as narrow as practicable and keep the sides of the trenches undisturbed until backfilling has been completed. Provide a clear distance of 12 inches on each side of the pipe.

6. The final 6 inches of excavation and grading of the trench bottom shall be performed by hand so as not to disturb the material below the grade required for setting the pipe or appurtenances.

a. Where suitable bedding materials will be placed and compacted throughout the length of the trench, hand excavation of the final 6 inches will not be required.

b. Grade the trench bottom to provide uniform bearing and support for the bottom quadrant of each section of pipe.

c. Excavate bell holes at each joint to eliminate point bearing.

d. Remove stones greater than 6 inches in any dimension from the bottom of the trench to avoid point bearing.

7. If satisfactory materials are not encountered at the design subgrade level, excavate unsatisfactory materials to the depth directed by the Engineer and properly dispose of the material. Backfill the resulting extra depth of excavation with satisfactory fill materials and compact in accordance with the provisions of this Section.

C. Backfill and Compaction

1. Unless otherwise specified or indicated on the Drawings, use satisfactory material removed during excavation for backfilling trenches. The Engineer and Agency Construction Coordinator may require stockpiling, drying, blending and reuse of materials from sources on the Project.

2. Spread and compact the material promptly after it has been deposited. When, in the Engineer's judgment, equipment is inadequate to spread and compact the material properly, reduce the rate of placing of the fill or employ additional equipment.

3. When excavated material is specified for backfill and there is an insufficient amount of this material at a particular location on the Project due to rejection of a portion thereof, consideration will be given to the use of excess material from one portion of the Project to make up the deficiency existing on other portions of the Project. Moving this excess material from one portion of the Project and placing it in another portion of the Project will be at no additional cost to the Owner.

a. Use borrow material if there is no excess of excavated material available at other portions of the Project.

4. Backfilling and compaction methods shall attain 95% of maximum dry density at optimum moisture content as determined in accordance with ASTM D1557.

5. Do not place stone or rock fragment larger than six inches in greatest dimension in the backfill.

6. Maximum loose lift height for backfilling existing or borrow material shall be 12 inches, unless satisfactory compaction is demonstrated otherwise to the Engineer through field-testing. In no case shall loose lift height for backfilling exceed 3 feet.

7. Do not drop large masses of backfill material into the trench endangering the pipe or adjacent utilities.

8. Install pipe in rock excavated trenches on a dense graded stone bedding with a minimum depth of 6 inches. Shape the stone bedding at the pipe bells to provide uniform support. Encase the pipe in the dense graded crushed stone bedding to a grade 6 inches over the top of the pipe and 12 inches on each side of the pipe.

9. Backfill from the bottom of the trench to the centerline of the pipe with the specified material. This initial backfill is to be placed in layers of no more than 6 inches and thoroughly tamped under and around the pipe. This initial backfilling shall be deposited in the trench for its full width on both sides of the pipe, fittings and appurtenances simultaneously.

10. Electrical conduit not encased in concrete, shall be backfilled with gavel/sand cushion conforming to the requirements of Section 312300. The backfill shall be placed in the trench for its full width and shall extend to 12 inches over the pipe.

11. Where excavation is made through permanent pavements, curbs, paved driveways or paved sidewalks, or where such structures are undercut by the excavation, place the entire backfill to sub-grade with granular materials and compact in 6 inch layers. Use approved mechanical tampers for the full depth of the trench. If required, sprinkle the backfill material with water before tamping so as to improve compaction.

12. Place and compact backfill around manholes, vaults, pumping stations, gate boxes or other structures in six inch layers, from a point 1 foot over the pipe. Exercise care to protect and prevent damage to the structures.

D. Test Pit Excavation

1. General requirements of test pits are specified in Section 023000.

E. Dewatering

1. Provide, operate and maintain adequate pumping, diversion and drainage facilities in accordance with the approved dewatering plan to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. Locate dewatering system

components so that they do not interfere with construction under this or other contracts.

2. Take actions necessary to ensure that dewatering discharges comply with permits applicable to the Project. Dispose of water from the trenches and excavations in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.

3. Repair any damage resulting from the failure of the dewatering operations and any damage resulting from the failure to maintain all the areas of work in a suitable dry condition, at no additional cost to the State.

4. Exercise care to ensure that water does not collect in the bell or collar holes to sufficient depth to wet the bell or collar of pipes waiting to be jointed.

5. Take precautions to protect new work from flooding during storms or from other causes. Control the grading in the areas surrounding all excavations so that the surface of the ground will be properly sloped to prevent water from running into the excavated area. Where required, provide temporary ditches for drainage. Upon completion of the work, all areas shall be restored to original condition.

6. Brace or otherwise protect pipelines and structures not stable against uplift during construction.

7. Do not excavate until the dewatering system is operational and the excavation may proceed without disturbance to the final subgrade.

8. Unless otherwise specified, continue dewatering uninterrupted until the structures, pipes, and appurtenances to be installed have been completed such that they will not float or be otherwise damaged by an increase in groundwater elevation.

9. If open pumping from sumps and ditches results in “boils”, loss of fines, or softening of the ground, submit a modified dewatering plan to the Engineer within 48 hours. Implement the approved modified plan and repair any damage incurred at no additional cost to the State.

10. Where subgrade materials are unable to meet the subgrade density requirements due to improper dewatering techniques, remove and replace the materials in accordance with Section 312300 at no additional cost to the State.

11. Notify the Engineer immediately if any settlement or movement is detected of survey points adjacent to excavations being dewatered. If settlement is deemed by the Engineer and Agency Construction Coordinator to be related to the dewatering, submit a modified dewatering plan to the Engineer within 24

hours. Implement the approved modified plan and repair any damage incurred to the adjacent structure at no additional cost to the State.

12. Dewatering discharge:

    a. Install sand and gravel, or crushed stone, filters in conjunction with sumps, well points, and/or deep wells to prevent the migration of fines from the existing soil during the dewatering operation.

    b. Transport pumped or drained water without interference to other work, damage to pavement, other surfaces, or property. Pump water through a silt filter bag prior to discharge to grade of drainage system.

    c. Do not discharge water into any sanitary sewer system.

    d. Provide separately controllable pumping lines.

    e. The Engineer reserves the right to sample discharge water at any time.

13. Install erosion/sedimentation controls for velocity dissipation at point discharges onto non-paved surfaces.

14. Removal

    a. Do not remove dewatering system without written approval from the Engineer.

    b. Backfill and compact sumps or ditches with screened gravel or crushed stone in accordance with Section 312300.

    c. Remove well points and deep wells. Backfill abandoned well holes with cement grout having a water cement ratio of 1 to 1 by volume.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Processed Aggregate Base for Bituminous Concrete Pavement Base
2. Gravel Borrow
3. Granular Fill
4. Gravel/Sand Cushion for Pipe Bedding
5. Modified Rip Rap
6. Subbase
7. Crushed Stone for Pipe Bedding

1.2 REFERENCES

A. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

B. ASTM C117 - Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

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

D. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb./ft^3)

E. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

F. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

H. AASHTO – Standard Specification for Transportation Materials and Methods of Sampling and Testing, 1986 Edition as amended

I. Connecticut Department of Transportation (CTDOT), Standard Specifications for Roads, Bridges, and Incidental Construction, 'Form 816', latest revision.

1.3 SUBMITTALS

A. Representative Samples of borrow materials taken from the source. Tag, label, and package the Samples as requested by Engineer and Agency Construction Coordinator. Provide access to the borrow site for field evaluation and inspection.

B. Provide sieve analysis (ASTM C136) and permeability analysis (ASTM D2434) from certified soils testing laboratory for all borrow materials. Take and test a sample, at no additional cost to the Owner for each 1,500 c.y. of borrow material placed.

C. Provide modified proctor analysis (ASTM D1557) from certified soils testing laboratory for all borrow materials.

D. The Engineer reserves the right to require more frequent testing than that which is specified above should the borrow characteristics change.

1.4 QUALITY ASSURANCE

A. No borrow shall be placed prior to the approval of Samples by the Project Geotechnical Engineer.

1.5 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. Comply with any environmental requirements and restrictions.

2. Keep all public and private roadway surfaces clean during hauling operations and promptly and thoroughly remove any borrow or other debris that may be brought upon the surface before it becomes compacted by traffic. Frequently clean and keep clean the wheels of all vehicles used for hauling to avoid bringing any dirt upon the paved surfaces.

PART 2 PRODUCTS

2.1 PROCESSED AGGREGATE BASE FOR BITUMINOUS CONCRETE PAVEMENT BASE

A. Shall conform to the requirements of CTDOT Form 816, article M.05.01-1. Coarse aggregate shall conform to the requirements of article M.05.01-2(a) or M.05.01-2(b). The reclaimed miscellaneous aggregate, article M.05.01-2(c) is not acceptable.

2.2 GRAVEL BORROW

A. Gravel borrow shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. The

coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

Gradation requirements for gravel shall be determined by AASHTO-T11 and T27 and shall conform to the following:

Sieve	Percent Passing
1/2 inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

Maximum size of stone in gravel shall be 2 inches.

2.3 GRANULAR FILL

A. Granular Fill to be used as fill material to achieve gravel base grade beneath structures, pavement, or other area requiring structural fill shall consist of inert material that is hard, durable stone and sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

B. Gradation requirements for Granular Fill shall conform to the following:

Sieve Size	Percent by Weight Passing Through	
	Minimum	Maximum
2/3rds loose lift thickness	100	-
No. 10	30	95
No. 40	10	70
No. 200	0	15

2.4 GRAVEL/SAND CUSHION FOR PIPE BEDDING

A. Sand borrow material shall be supplied from an off-site borrow area approved by the Engineer. Testing of the off-site sand borrow shall be at the Contractor's expense.

B. Sand borrow shall consist of clean, inert, hard, durable grains of quartz or other hard, durable, rock, free from loam or clay, surface coatings and deleterious materials. The allowable amount of material passing a No. 200 sieve as determined by ASTM-C117 shall not exceed 10% by weight.

C. Material shall consist of a clean, non-plastic, granular material conforming to the requirements of a SW, SP or SM under the Unified Soil Classification System (USCS) (ASTM D2487).

D. The material shall have the characteristics that when placed and compacted, the soil particles will bind together so as to form a solid, stable surface capable of supporting rubber-tired vehicular traffic during wet weather periods as well as extended dry weather periods. The borrow material shall not contain fines to the extent that the surface layer becomes "greasy" when wet.

E. The material shall not contain stones larger than 3/8 inch in diameter.

F. Material consisting of frozen clogs, ice and snow will be rejected.

G. All sand borrow material to be used shall be subject to approval by Engineer and Agency Construction Coordinator, and the Engineer and Agency Construction Coordinator reserves the right to reject any borrow material from the job that does not meet the above requirements.

2.5 MODIFIED RIP RAP

A. Placed Modified Rip Rap

1. The material shall meet the requirements of CTDOT Form 816, article M.12.02-3 Modified Riprap.

2. Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified. Stones smaller than the specified 10% size and spall will not be permitted in an amount exceeding 10% by weight of each load.

2.6 SUBBASE

A. All materials for this work shall conform to the requirements of Articles M.02.02-1 and M.02.06 Gradation “B” of CTDOT, “Form 816”.

2.7 CRUSHED STONE FOR PIPE BEDDING

A. Shall conform to the requirements of CTDOT, “Form 816” Article M.01.01, No. 6 stone.

PART 3 EXECUTION

3.1 INSTALLATION

A. Prior to the placement of borrow material, site preparation shall be completed as required by the Contract Documents, and approved by the Engineer.

B. Ensure that all materials are properly stockpiled on site to prevent contamination by other materials.

C. Place borrow material over the entire area in uniform lifts and compact in accordance with Section 310000.

D. Utilize on-site soils prior to using off-site borrow provided on-site soils meet the requirements of the specifications.

E. Utilize gravel borrow in all locations where a surface treatment has not been specified but requires a firm finish surface.

F. Processed aggregate base for bituminous concrete pavement base is intended to provide a stable foundation for driveways, bituminous concrete sidewalk and roadway repair.

G. Borrow materials shall be used as a replacement for unsuitable materials where poor soil conditions are encountered during the progress of the work, where approved by the Engineer. Borrow type will be determined by the Engineer. Borrow material used as a replacement for unsuitable soil is not intended to be an aid to dewatering.

H. Shape borrow used for pipe foundation material so that it supports the pipe properly and will not damage the pipe, bells, collars, or the pipe fittings.

I. Place all borrow to keep it free of other materials and to prevent segregation.

J. Place gravel/sand cushion for water main pipe bedding. Gravel/sand cushion shall have an in-place permeability of 1×10^{-3} cm/sec or greater, and shall be compacted to 95% of maximum dry density.

K. Carry out compaction testing in accordance with ASTM D1556 (sand cone), or D6938 (Nuclear Methods). Unless stated elsewhere in the contract documents, the number of tests required shall be no less than 5 tests per acre or at random locations.

L. Maintain and repair all eroded areas during the life of this contract at no additional cost to the State.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this section.

1.2 SUMMARY

A. General: Perform trench excavation and backfill in accordance with the Contract Documents. The Work includes but is not limited to trench excavation and backfill to within five (5) feet of proposed building for the following:

1. Site Storm drainage, sanitary sewers, water distribution and utility services construction.

2. Provide temporary paving or surfacing such as stabilized crushed stone so that traffic may be restored as soon as possible after completion of utility Work.

B. Related Sections include the following:

1. Section 312500 –Sedimentation and Erosion Control

2. Section 334113 – High Density Polyethylene Pipe and Fittings

3. Section 334100 - Storm Drainage

1.3 COORDINATION

A. Coordinate and schedule the work of this Section with all trades involved to prevent interference, and in order to allow adequate time at the proper stage of construction to properly perform all work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall comply with CTDOT Form 816, “Standard Specifications for Road, Bridges, and Incidental Construction” latest revision.

B. Materials installed within Camp Niantic Roadway Right-of-Way shall conform with the CTARNG standards and requirements.

PART 3 - EXECUTION

3.1 EXCAVATION, TRENCHING AND BACKFILL

A. General: Perform excavation to the depths shown or specified.

B. During excavation, pile material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins.

C. Remove all excavated materials not required or suitable for backfill from the site.

D. Grade as necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein by pumping or by other approved method.

E. Install sheeting and shoring as necessary for the protection of the Work and for the safety of personnel.

F. Unless otherwise indicated, excavation to be open cut.

G. Excavation is classified as earth excavation and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered, pavements, and other obstructions visible on ground surface, underground structures, utilities and other items indicated to be demolished and removed, together with earth and other materials, excluding rock.

H. Rock, for the purposes of classification shall consist of rock material in beds, ledges , unstratified masses, conglomerate deposits and boulders of rock material that exceed 1 cubic yard that cannot be removed by rock excavating equipment without systematic drilling, ram hammering, ripping or blasting. Rock excavating equipment is defined as a late-model, track-mounted, hydraulic excavator equipped with a 42-inch wide, maximum, short-tip radius rock bucket, rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.

I. Backfill and surface excavations for utilities occurring in or across streets or sidewalks with temporary paving or crushed stone as soon as possible after Work is completed.

J. Maintain temporary paving or surfacing in a condition acceptable to the Agency Construction Coordinator until permanent pavement can be installed.

3.2 SIZES OF TRENCHES

A. Ensure trenches are the necessary width for the proper laying of the pipe, and ensure the banks areas nearly vertical as practicable.

B. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length.

C. Except where rock is encountered, take care not to excavate below the depths indicated or specified.

D. Where rock excavations are required, excavate the rock to a minimum overdepth of 6 inches below the trench depths indicated on the drawings or specified.

E. Backfill overdepths in the rock excavation and unauthorized overdepths with thoroughly compacted sand or gravel as specified.

F. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the Government's Geotechnical Consultant, is encountered in the bottom of the trench, remove such soil to the depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.

G. Ensure trenches for utilities are of a depth that will provide the following minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown:

1. 4.5' minimum cover for water lines, sanitary sewers; gas mains and the like carrying fluids.

2. 2.5' feet minimum cover for electrical and telephone conduit and storm sewers.

H. For bedding of piping, ensure the width of the trench at and below the top of the pipe is such that the clear space between the barrel of the pipe and the trench wall is between 6 and 12 inches on either side of the pipe.

I. Ensure the width of the trench above the pipe crown is as wide as necessary for sheeting and bracing and the proper performance of the Work.

J. Round the bottom of the trench so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil for as nearly as the full length of the barrel as proper joining operations will permit.

K. Ensure the part of the excavation described in subsection J above is performed manually only a few feet in advance of the pipe laying by men skilled in this type of Work.

3.3 EXISTING UTILITY LINES

A. Contact "Call Before You Dig" at 1-800-922-4455 at least 48 hours in advance of any construction to verify the location of utilities.

B. Protect existing utility lines to be retained that are shown on the drawings or the locations of which are made known to the General Contractor prior to excavation operations from damage during excavation and backfilling. If such lines are damaged, the Contractor will repair at his expense.

3.4 BACKFILL RESTRICTIONS AND REQUIREMENTS

A. Do not backfill trenches until all required pressure and other tests have been performed and until the utilities systems as installed conform to the requirements of the drawings and specification.

B. Carefully backfill the trenches with the excavated materials approved for backfilling consisting of earth, loam, sand, sand and gravel, soft shale or other approved materials, free from large clods of earth, stones over 2-1/2 inches maximum dimension, or other undesirable material as specified in Section 310000 “Earthwork”. Deposit backfill in 6 inch layers then thoroughly and carefully tamp until the pipe has a cover of not less than one (1) foot.

C. Carefully place the remainder of the backfill material in the trench in one foot layers and tamp. Settling the backfill with water is not permitted.

D. Grade the surface to a reasonable uniformity and leave the mounding over trenches in a uniform and neat condition.

E. The Government’s Geotechnical Consultant and Agency Construction Coordinatormay reject any on-site or borrow materials which he considers unsuitable for intended backfill or fill usage.

F. Under all paved areas, compact the fill and/or backfill to 95% of the maximum density at optimum moisture when tested in accordance with ASTM Designation D1557.

G. Perform field density tests by the approved Soil Testing Laboratory at locations and elevations as directed. In general, take test samples for every 250 cubic yards of fill or backfill placed or at 100 linear foot intervals of trench backfilled.

H. Backfill trenches excavated under footings and within 18 inches of bottom of footings with compacted select backfill; fill with concrete to elevation of bottom of footings..

3.5 TRAFFIC CONTROL

A. Maintain access for vehicular and pedestrian traffic required for other construction activities and for public when working in roadway right-of-way.

B. Provide public flagmen, barricades, warning signs and warning lights as required. Obtain required Camp Niantic authorizations before start of work.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Dust control
2. Drainage and erosion control
3. Haybales and siltation fence
4. Sediment trapping devices

B. Related Sections – Not Used

1.2 SUBMITTALS – NOT USED

PART 2 PRODUCTS

2.1 HAYBALES

A. Haybales required for siltation control shall be wire tied bales of the type normally used for siltation or erosion control or construction projects.

2.2 FILTER FABRIC

A. Filter fabric siltation fencing shall be a woven filter fabric having a weight of at least 2.5 ounces per square yard, a thickness of at least 17 mils, a coefficient of permeability of not less than 0.0009 centimeters per second and allows a water flow rate of a minimum 40 gallons per minute per square yard. The material shall have a high sediment filtration capacity, high slurry flow and minimum clogging characteristics. The material shall be equal to FW-300 as manufactured by Mirafi, Inc., Charlotte, North Carolina; Amoco 2130 by Nilex, Inc., Centennial, CO; MISF 180 by Mutual Industries, PA; or equal.

2.3 SEDIMENT TRAPPING DEVICES

A. Sediment trapping devices shall be Siltsack®, Dandy Bag II®, or equal.

2.4 MULCH

A. Hay mulch shall consist of mowed cured grass, clover, alfalfa, timothy, oats, or wheat. No salt hay shall be used.

PART 3 EXECUTION

3.1 DUST CONTROL

A. Control dust during the Work. Use a mechanical street sweeper as needed or at the request of the Engineer.

B. Prevent dust from becoming a nuisance or hazard. During construction, excavated material and open or stripped areas are to be policed and controlled to prevent spreading of the material.

C. Control dust during the work on-site using calcium chloride and/or water.

D. During the Work on-site, all paved road and driveway surfaces shall be scraped and broomed free of excavated materials on a daily basis. The surfaces shall be hosed down or otherwise treated to eliminate active or potential dust conditions and the natural road or wearing surface shall be exposed.

E. Ensure that the existing equipment, facilities, and occupied space adjacent to or nearby areas of the work do not come in contact with dust or debris as a result of concrete demolition, excavation or surface preparation for coatings.

F. Control dust by the construction of temporary wooden frame/polyethylene sheeting walls and covering enclosures separating adjacent or nearby areas and equipment from the Work site.

3.2 DRAINAGE AND EROSION CONTROL

A. Control erosion and siltation during the construction through mulching, haybales, siltation fencing, diversion and control of storm water run-off, ponding areas and similar methods.

B. Provide and maintain sediment trapping systems.

C. Discharge surface runoff from any disturbances to the site into silt containment basins. Utilize siltation prevention measures including haybale and geotextile fences before discharge to drainage systems.

D. Control surface waters within the construction area through the use of temporary culverts.

E. Install sediment trapping devices in catch basins located in existing paved areas with sediment trapping devices to minimize the transport of sediment through the subsurface stormwater collection system.

3.3 HAYBALES AND SILTATION FENCE

A. Place and maintain both haybales and a staked filter fabric siltation fence along the entire length of the proposed construction between the area of construction and where shown on the Drawings or required by permit.

B. Install haybales by anchoring bales butted together to existing ground with at least 2 stakes per bale. The stake shall be a minimum of one inch square cross section and shall be long enough to penetrate 12 inches into the ground. Replace deteriorated haybales. Remove and dispose of the haybales following the successful growth of vegetation in the areas disturbed by the construction. Haybales shall not be removed until their removal is approved by the Engineer and Agency Construction Coordinator.

C. Install a filter fabric siltation fence in addition to the staked haybales, prior to construction and remove after full surface restoration has been achieved. Install the siltation fence parallel and immediately adjacent to the haybales as shown on the Drawings. Install as follows:

1. Hand shovel excavate a small trench on the upstream side of the desired fence line location.

2. Unroll the siltation fence system, position the post in the back of the trench (downhill side), and hammer the post at least 1½ feet into the ground.

3. Lay the bottom 6 inches of the fabric into the trench to prevent undermining by storm water run-off.

4. Backfill the trench and compact.

3.4 RESTORATION

A. Provide erosion control, seed and mulch and netting for surface restoration of areas disturbed during construction activities.

B. Provide temporary stabilization of disturbed areas that remain inactive greater than 14 consecutive days to minimize erosion. Methods to minimize erosion may include but are not limited to:

1. Spreading straw and/or providing temporary planting stabilization.

2. Installing jute netting.

3. Preparing surfaces to increase the runoff flow path, reduce the runoff flow velocity, or create small storage pockets to retain surface flows. Methods of accomplishing this include using mechanical devices such as track equipment or sheep's foot rollers.

C. Place mulch on seeded areas. Use jute netting on areas having a slope greater than 3 horizontal to 1 vertical, to anchor the mulch until a satisfactory growth is obtained. If seeding is not possible because of the time of the year, apply mulch and netting to stabilize the area until such time as seed can be sown.

D. Provide grading, refertilizing, reseeding, remulching and/or netting to maintain the restored areas until the Work is accepted by the Agency Construction Coordinator.

E. See Landscape Specifications for seed.

3.5 CLEANING

A. Remove any sediment that builds up around the haybales or catchbasins.

B. Clean sediment trapping devices periodically during the Work. Devices shall be cleaned on a weekly basis, or more frequently if the devices become clogged.

C. Clean catchbasins that collect sediment as a result of the Work.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

A. Work in this Section includes everything necessary and proper for, or incidental to, executing and completing work as required by this Section and as reasonably inferable from Drawings, including but not necessarily limited to following:

1. Providing and installing separation fabric.

1.2 RELATED SECTIONS

A. Section 312500– Sediment and Erosion Controls

1.3 QUALITY ASSURANCE

A. Applicable operations, materials and methods shall be in accordance with State of Connecticut Department of Transportation – Standard Specifications for Roads, Bridges and Incidental Construction – Form 816, 2004 and all addenda thereto.

B. Filter Fabric shall be listed on the "Qualified Product List for Connecticut Department of Transportation Products, December 2010, Report No. CT 211-17-10-9" published by the Connecticut Department of Transportation, Bureau of Engineering and Construction, Office of Research and Materials.

1.4 SUMBITTALS

A. Submit the manufacturer's full product data for separation fabric to the Engineer and obtain his approval before ordering.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver fabric in rolls in original wrapping adequate to protect fabric from ultraviolet radiation and abrasion during shipping and handling. Do not leave rolls of fabric or installed fabric unnecessarily exposed to light. Cover installed fabric with overlying material without delay. Do not exceed total accumulated exposure of 2 weeks.

1.6 PROJECT CONDITIONS

A. Coordinate work under this Section closely with work of other trades of other Sections whenever such work affects or is affected by work included herein.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Filter Fabric – Non woven, needle punch polypropylene, with high resistance to abrasion, punctures and tearing,; good light blockage, ultraviolet light resistance, water permeability, coefficient of friction, and substrata conformity.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine underlying surface where filter fabric is to be installed. Insure that surfaces are free of debris and construction activity by other trades. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Lay filter fabric loosely so that underlying material is fully covered and in close contact.

B. Overlap edges and ends of sections, minimum 6 inches. Lap up, under and over adjacent materials as indicated on drawings. Where fabric turns up at edges toward finish grade to close off intrusion or escape of overlying soil or granular material, keep fabric edges 1” below finish grade where it will not be exposed to view. Trim away excess fabric.

3.3 PROTECTION

A. Protect installed fabric from being torn, shifted and covered with debris and contaminants. Replace, clean and repair as necessary. Patch tears with squares of fabric lapped 12 inches all around tear. Sew patch securely in place.

3.4 CLEANING

A. Clean work areas of excess materials and debris.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. The work under this Section shall consist of bituminous concrete placed upon a completed processed aggregate base course or upon the surface of an existing pavement. The work shall be installed in accordance with the line, compacted thickness and details shown on the Contract drawings.

B. The work shall include, but not limited to the following:

1. New Pavement

2. Pavement overlay

3. Permanent pavement repair

4. Bituminous Concrete Curbing

5. Formation of Subgrade:

   The area upon which pavements, concrete walk, concrete aprons, structures, site retaining walls, or any other proposed improvements are to be placed shall be known as the subgrade. This is the plane coincident with the bottom of the base, or compacted granular fill, as shown on the Contract Drawings or as directed. The work of this Section shall be performed at this plane

6. Bituminous Tack Coat

1.2 QUALITY ASSURANCE

A. Codes and standards: Comply with provisions of following, except otherwise indicated:

1. Reference to “Form 816” means the State of Connecticut Department of Transportation “Standard Specification for Roads, Bridges and Incidental Construction, 2004”, including any interim and supplemental specification.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contact and Division 1 Specification Sections:

B. Submit Material Certificates of Bituminous Mixture (Class) and Tack Coat signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1. The paint shall be capable of being applied to bituminous and portland cement concrete pavements with striping equipment that does not require heating above ambient temperatures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Bituminous Concrete Pavement:

1. Material for Bituminous Concrete Pavement and Bituminous Bases shall comply with Section M.04 of “Form 816”.

2. The class of bituminous and compacted thickness shall be as indicated on the Contract Drawings.

B. Bituminous Tack Coat:

1. Unless otherwise indicated on the Contract Drawings, the bituminous material for this work shall conform to the requirements of M.04.01 of “Form 816” for Grade SS-1 Emulsified Asphalt. Applications temperatures shall be between a minimum of 75 F and a maximum of 140 F.

2. The bituminous material shall be diluted with an equal amount of suitable emulsifier solution and thoroughly mixed into a homogeneous liquid.

PART 3 – EXECUTION

3.1 CONSTRUCTIONS METHODS

1. Bituminous Concrete for Pavement shall comply with Article 4.06.03 of “Form 816”.

2. Formation of subgrade shall comply with Article 2.09.03 for “Form 816” and as modified as herein.

a. In areas where unsuitable material has been removed, the existing ground shall be compacted prior to the placement of compacted granular fill.

b. After all grading has been substantially completed and all underground work complete, the subgrade material shall be brought to the required lines and grades.

c. All soft and yielding material and other portions of the subgrade which will not readily compact shall be removed and replaced with approved compacted granular fill.

d. Compact the subgrade with approved power roller vibratory roller or compactor. The dry density of all areas after compaction shall be not less than 95 percent. After compaction, the top surface fo the subgrade shall be fine graded to within 2 inches of the required elevation. Permit proper drainage.

e. Protect the completed subgrade from damage until any foundation or surfacing materials is placed thereon.

3. Bituminous Concrete Tack Coat shall comply with the following:

a. Weather Limitations – The tack coat shall be applied only when the existing surface is dry, when the atmospheric temperature is above 60 F, and when the weather is not foggy or rainy.

b. Equipment – The equipment used by the Contractor shall include a self-powered pressure bituminous distributor and equipment for heating bituminous material.

The distributor shall have pneumatic tires and it shall be designed, equipped, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at readily controlled rates from 0.05 to 2.0 gallons per square yard. The material shall be applied within a pressure range of 25 to 75 pounds per square inch and within allowable variation from any specified rate not to exceed 5%. Distributor equipment shall include a tachometer, pressure gauges, volume-measuring devices, and a thermometer for reading temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. Distributors shall be equipped with an approved bituminous material sampling valve. When samples are taken through such valves, they shall be considered representative of all material in the tank.

Smaller power spray units or hand spray equipment may be used in areas where the Agency ConstructionCoordinator determines that the use of a distributor is impractical.

c. Preparation of Surface to be Treated: The existing surface shall be patched and cleaned to provide a reasonably smooth and uniform surface to receive treatment. Unstable corrugated areas shall be removed and

replaced with patching materials, determined suitable by the Agency Construction Coordinator.

The edges of existing pavements, which are to be adjacent to new pavements, shall be cleaned to permit the adhesion of bituminous materials.

d. Application of Bituminous Material - The bituminous material shall be applied using approved pressure distribution equipment in a manner to provide a uniform spray covering. The rate of application shall furnish a uniform asphalt residue on the original surface from 0.05 to 0.07 gallon per square yard of bituminous material (0.10 to 0.15 gallon per square yard of diluted material) within the specified temperature range.

All uncoated or lightly coated areas shall be satisfactorily corrected. All areas showing an excess of bituminous material shall be corrected with a covering of sufficient dry sand to effectively blot up or remove the excess tack coat material.

Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Agency Construction Coordinator.

No more area shall be tack coated than can be properly cured and covered with the new surface within the same day.

e. Protection of Treated Surfaces - The surface shall be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Sidewalks including wheelchair ramps

2. Driveway Aprons

3. Concrete Curbs

B. Related Sections

1. Section 310000 - Excavating, Backfilling, Compaction and Dewatering

2. Section 312300 - Borrow Material

1.2 REFERENCES

A. ACI 301 (American Concrete Institute) - Specifications for Structural Concrete for Buildings.

B. ACI 304 (American Concrete Institute) - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

E. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

F. ASTM C33 - Concrete Aggregates.

G. ASTM C94 - Ready Mix Concrete.

H. ASTM C150 - Portland Cement

I. ASTM C260 - Air-Entraining Admixtures for Concrete.

J. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

K. ASTM C494 - Chemical Admixtures for Concrete.

L. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

M. ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

N. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1986 Edition, as amended.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland cement concrete shall be an Air-Entrained 4,000 psi, ¾-inch mix in accordance with CTDOT Form 816, Article M.03.01.

B. Premolded expansion joint filler shall meet the requirements of AASHTO Designation M153, Type II.

C. Premolded expansion joint filler shall meet the requirements of AASHTO M 213.

D. Concrete sidewalk and curb base shall be CTDOT Form 816, Article M.01.01, No. 6 Stone.

E. Sheet membrane curing compounds shall meet the requirements of ASTM C 309.

PART 3 PART 3 EXECUTION

3.1 PREPARATION

A. Shape the subgrade parallel to the proposed surface and compact thoroughly. Fill depressions with suitable material and compact again until the surface is smooth and hard.

B. Install a crushed stone base to a depth shown on the plans on top of the subgrade. Fine grade the crushed stone base and compact thoroughly with approved mechanical tampers.

C. Place Portland cement panels five inches thick for sidewalks and eight inches thick for driveways and driveway aprons in accurately set, smooth wooden or steel forms of sufficient strength to resist springing out of shape. The crushed stone base shall be fine graded and recompacted immediately ahead of pouring the concrete. Sidewalks shall match the top of the existing adjacent sidewalk panels.

D. Completely remove mortar and dirt from forms that have been previously used. The forms shall be well staked and thoroughly graded and set to the established lines with their upper edge conforming to the grade of the finished walk. Oil forms before placing concrete.

3.2 INSTALLATION

A. Reinforce the concrete slab with welded wire fabric, 6x6-W4 x W4.

B. Place concrete to half the desired depth at which point the welded wire fabric shall be placed or raised to the surface. The remaining concrete can then be placed. Care should be exercised to avoid walking in areas with reinforcing

C. No finish work shall be performed while free water is present. After water sheen has disappeared and concrete has started to stiffen, edging operations, where required, shall be completed. After edging and joining operations, the surface shall be floated. Immediately following floating, the surface shall be steel-troweled. Following troweling, the concrete sidewalk shall be given a broom finish.

D. Cure the concrete by covering with burlap or other acceptable material that shall be kept moist for at least five (5) days after placing the concrete.

E. Cure the concrete by the application of a liquid membrane-curing compound as soon as free water has disappeared and the surface cannot be marred. The application should be uniform and without puddles.

END OF SECTION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes

1. New painted epoxy resin pavement markings
2. Replacement of pavement markings disturbed as part of construction activities.
3. The work of this Section shall also consist of furnishing and installing sheet aluminum/reflective sheeting signs, and galvanized steel support posts as indicated on the plans.

B. Related Sections

1. Section 321216 - Bituminous Concrete Pavement
2. Section 321600 – Portland Cement Concrete Sidewalks and Curbs

1.2 REFERENCES

A. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1986 Edition, as amended.

B. State of Connecticut Department of Transportation – Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004 (CT-DOT Form 816), as amended.

C. Federal Highway Administration - Manual of Uniform Traffic Control Devices for Street and Highways, 2009 Edition, as amended.

D. National Cooperative Highway Research Program – Report 350: Recommended Procedures for the Safety and Performance Evaluation of Highway Features, 1993, as amended.

1.3 SUBMITTALS

A. Submit material specifications and shop drawings for all materials furnished under this Section including, but not limited to the following:

1. Pavement marking paint
2. Sheet Aluminum/reflective sheeting signs
3. Galvanized Steel Support Posts

PART 2 PRODUCTS

2.1 MATERIALS

A. Epoxy resin pavement markings, symbols and legends

1. In accordance with Connecticut Department of Transportation – Standards for Roads, Bridges and Incidental Construction, Form 816, 2004, as amended, pavement marking paint shall conform to the requirements of Section 12.10 Epoxy Resin Pavement Markings, Symbols, and Legends.

2. Epoxy resin pavement markings includes epoxy resin installed with a truck mounted machine such as center lines, lane lines, and shoulder lines. Epoxy resin pavement markings, symbols and legends, include stop bars, crosswalks, parking stalls, lane arrows, legends, and markings within areas such as paved islands, gore areas and paved medians.

3. Materials for this work shall conform to the requirements of Article M.07.22 of Form 816

4. Glass beads conforming to the requirements of Grading “B” (larger beads) shall be applied at a rate of 12 pounds per gallon of epoxy pavement marking material, immediately followd by a second drop of glass beads conforming to the requirements of Grading “A” (smaller beads) applied at a rate of 13 pounds per gallon of epoxy pavement marking material.

   Crosswalks shall only incorporate glass beads conforming to the requirements of Grading “A” (smaller beads) applied at a rate of 25 pounds per gallon of epoxy pavement marking material.

B. Signs and support posts shall conform to the requirements of Article 12.08.02 of "Form 816".

PART 3 EXECUTION

3.1 PREPARATION

A. All surface dirt within the areas to be painted shall be removed. Large areas of tar, grease or foreign materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal.

B. Application of markings shall not proceed until final authorization is received from the Agency Construction Coordinator.

C. Bituminous concrete pavements shall have been in place for at least 48 hours prior to the application of pavement markings.

3.2 INSTALLATION

A. All permanent pavement repair areas shall be repainted to match the original pavement markings.

B. New pavement markings shall be as shown on the Drawings and as specified herein.

C. Painting shall be in accordance with Connecticut Department of Transportation – Standards for Roads, Bridges and Incidental Construction, Form 816, 2004, as amended.

D. No paint or pavement marking material shall be heated above the temperature marked on the container.

E. All painting shall be performed in a neat and workmanlike manner.

F. Lines shall sharp and clear with no feathered edging or fogging.

If for any reason material is spilled or tracked on the pavement or any markings applied by Contractor, in Engineer's or Agency Construction Coordinator's judgment, are not acceptable, then the Contractor shall remove such material by a method that shall not damage the roadway surface and is acceptable to Engineer or Agency Construction Coordinator, clean and prepare the surface for a reapplication of markings, and reapply the markings as directed without additional compensation for the corrective work.

G. Signs and support posts shall be installed in accordance with Article 12.08.03 of "Form 816".

3.3 PROTECTION

A. Markings shall remain protected until sufficiently dry to bear traffic on roadways that are open to traffic.

B. Precautions shall be taken to prevent tracking by tires of the striping equipment.

C. Markings shall be protected by traffic cones of not less than 28 inches in height.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Restoration of all vegetated areas disturbed during construction including:

   a. Lawn areas

   b. Grass surfaces

2. New loam and seed areas

3. Loam, starter fertilizer, lime, lawn seed,

4. Mulch

1.2 REFERENCES

A. ASTM D5539 – Standard Specification for Seed Starter Mix

1.3 QUALITY ASSURANCE

A. Place seed only between the periods from April 15th to June 1st, and from August 15th to October 1st, unless otherwise approved by the Engineer.

1.4 SUBMITTALS

A. Submit the following for approval:

1. Lawn seed mixture including percent by weight of each seed type, and manufacturer/supplier name.

2. Suitable laboratory analysis of the soil to determine the quantity of fertilizer and lime to be applied.

3. Lime and starter fertilizer application rates based on laboratory soil tests.

PART 2 PRODUCTS

2.1 MATERIALS

A. Loam

1. Loam shall consist of fertile, friable, natural topsoil typical of the locality without admixture of subsoil, refuse or other foreign materials and shall be obtained from a well-drained arable site. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in and about equal proportions. It shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter. Topsoil as delivered to the site or stockpiled shall have pH between 6.0 and 7.0 and shall contain not less than 5 percent or more than 8 percent organic matter as determined by loss of ignition of moisture-free samples dried at 100 degrees Celsius. The topsoil shall meet the following mechanical analysis:

	PERCENTAGE FINER
1-in screen opening	100
No. 10 mesh	95 to 100
No. 270 mesh	35 to 75
0.002 mm*	5 to 25

* Clay size fraction determined by pipette or hydrometer analysis.

2. Place a minimum of 4 inches of loam.

B. Starter Fertilizer

1. Starter fertilizer shall bear the manufacturer's name and guaranteed statement of analysis, and shall be applied in accordance with the manufacturer's directions.

2. Starter fertilizer shall be Scott's Starter Fertilizer, or equal, with timed nitrogen release to prevent burning.

C. Lime

1. Lime shall be an agricultural type ground limestone.

2. Lime shall be pelletized type for prolonged time release to soil.

D. Lawn Seed

1. Seed shall be of the previous year's crop.

2. Required ranges:

   a. Purity > 90%

   b. Germination > 80%

   c. Crop < 0.5%

   d. Weed < 0.3%

   e. Noxious Weed – 0%

   f. Inert < 8%

3. The standard seed mixture shall be applied at a minimum rate of 175 lbs./acre, 4 lbs./1,000 sf.

OPEN FIELD MIX	% WEIGHT
Red Fescue (Creeping)	60%
Red Top	10%
Crown Vetch	30%

4. The wetland seed mixture for the bottom of the sedimentation basin shall be "New England Erosion Control/Restoration Mix" for moist sites, as manufactured by New England Wetland Plants, Inc., or approved equal.

5. All seed shall comply with State and Federal seed laws.

6. A sworn certificate indicating each variety of seed, weed content, germination of seed, net weight, date of shipment and manufacturer's name shall accompany each seed shipment. Responsibility for satisfactory results rests entirely on the Contractor.

E. Mulch

1. Shall be a specially processed 100 percent Virgin wood fiber mulch containing no growth or germination-inhibiting factors. Wood fiber mulch shall be Second Nature Regenerated wood fiber as by Central Fiber Corporation, Wellsville, KS or equal. It shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogenous slurry. When sprayed on the ground, the material shall allow absorption and percolation of moisture. Each package of the wood fiber shall be marked by the manufacturer to show the air dry weight content and not contain in excess of 10 percent moisture.

PART 3 EXECUTION

3.1 PREPARATION

A. Salvage all existing loam and stockpile at an acceptable on-site location. Under no circumstances shall existing topsoil be removed from the Project site.

B. The ground surface shall be fine graded and raked to prepare the surface of the loam for lime, fertilizer and seed.

C. Perform a laboratory soil test on the proposed loam before placing any lime, fertilizer, or seed. This work shall be in accordance with ASTM D5539.

D. Loam surface that has been raked smooth and prepared for sod installation shall be watered as directed by grower for plant species supplied.

3.2 LAWN AREAS

A. Apply fertilizer and lime to the surface of the ground in accordance with the manufacturers' instructions, and based on the results of the certified soils test.

B. Place the seed using a drop or rotary spreader at the rate recommended by the seed manufacturer for the intended use of the lawn or grass area being restored.

C. After spreading the seed, lightly rake the surface to work the seed in. The surface shall then be rolled.

D. All seed on banks and slopes of three to one (3:1) and greater shall be netted and staked.

E. As sodding is completed in any one section, roll the entire section by making four passes with a hand roller weighing not more than 100 lbs/ft of width.

3.3 MAINTENANCE

A. Maintain loamed and seeded areas by mulching, covering, netting, watering and fencing until an acceptable stand of vegetation is approved by the Engineer.

B. The dressed and seeded areas shall be sprinkled with water as necessary from time to time. Signs and barricades should be placed to protect the seeded areas. After the grass has started to grow, all areas and parts of areas that fail to show a uniform stand of grass shall be seeded repeatedly until all areas are covered with a satisfactory growth of grass.

3.4 SPECIAL CONSIDERATIONS

A. Following the final top course of paving, all pavement edges, waterways, sidewalks and berms shall be brought to grade with loam, fine graded, raked, seeded, and rolled to the satisfaction of the Engineer. The final surface of the loam backup shall slope away from the surface edge to allow proper sheeting of runoff. The Contractor shall protect, maintain, and repair seeded areas until a satisfactory start of healthy grass is established.

3.5 RESTORATION

A. In locations where the Work passes through existing grass, weed brush or tree-surfaced areas that are not covered by a specific lawn repair item, surface restoration shall be as follows:

1. After completion of backfilling, the existing loam and organic ground cover materials that were salvaged during excavation shall be returned to the top of the trench.

2. After natural settlement and compaction has taken place, the trench surface shall be harrowed, dragged and raked as necessary to produce a smooth and level surface.

3. The area is then to be sowed with “orchard grass” or “rye grass” or other such materials to hold the soil and produce a growth similar to that existing prior to construction.

3.6 GUARANTEE PERIOD AND FINAL ACCEPTANCE

A. At the end of the guaranteed period, inspection will be made by the Engineer upon written request submitted at least 10 days before the anticipated date. Seeded areas not demonstrating satisfactory stands as outlined above, as determined by the Engineer, shall be renovated, reseeded and maintained meeting all requirements as specified herein.

B. After all necessary corrective work has been completed, the Engineer shall certify in writing the final acceptance of the seeded areas.

END OF SECTION

PART I – GENERAL

1.1 SUMMARY

A. Section Includes

1. Topsoil

1.2 SUBMITTALS

A. Provide representative samples of borrow materials taken from the source. Tag, label, and package the samples as requested by the Engineer or Agency Construction Coordinator. Provide access to the borrow site for field evaluation and inspection.

B. Provide analytical test results at the rate specified. Results shall indicate whether sample was taken from the upper or lower 6 inches of the vegetative support materials. All samples shall be representative and analyzed for the following:

pH
Nitrogen
Phosphorus
Potash
Grain size
Organic content

PART 2 PRODUCTS

2.1 MATERIALS

A. Vegetative Support Material

1. Vegetative support material shall consist of fertile, friable, natural topsoil typical of the locality without admixture of subsoil, refuse or other foreign materials and shall be obtained from a well-drained arable site. It shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in and about equal proportions. It shall be reasonably free of stumps, roots, heavy or stiff clay, stones larger than 1-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter. Topsoil as delivered to the site or stockpiled shall have pH between 6.0 and 7.0 and shall contain not less than 5 percent or more than 8 percent organic matter as determined by loss of ignition of moisture-free samples dried at 100 degrees Celsius. The topsoil shall meet the following mechanical analysis:

	PERCENTAGE FINER
1-in screen opening	100
No. 10 mesh	95 to 100
No. 270 mesh	35 to 75
0.002 mm*	5 to 25

* Clay size fraction determined by pipette or hydrometer analysis.

2. Prior to stripping, the topsoil shall have demonstrated; by the occurrence upon it of healthy crops, grass or other vegetative growth; that it is reasonably well drained and that it does not contain toxic amounts of either acid or alkaline elements.

2.2 EQUIPMENT

A. Earth Moving Equipment

B. Adequate types and number of equipment shall be used to ensure that the vegetative support material is spread evenly and at the proper depth to all areas intended to be covered without damaging underlying soil layers or structures.

PART 3 EXECUTION

3.1 INSTALLATION

A. Vegetative support material shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work will conform to the lines, grades and elevations indicated. No loam shall be spread in water or while frozen or muddy.

B. The vegetative support material shall be hauled, deposited, spread, compacted, tracked and raked to the lines and grades shown on the Plans or as directed by the Engineer or Agency Construction Coordinator. After the vegetative support material has been spread, it shall be carefully prepared for seeding by spading or harrowing, and raking. All large, stiff clods, lumps, stones, brush, roots, stumps, litter, and other foreign material shall be removed.

C. The compaction shall be equivalent to that produced by a hand roller weighing from 75 to 100 pounds per foot of width. The compaction may be obtained by rolling, dragging or any method that produces satisfactory results. All depressions caused by settlement or rolling shall be filled with additional materials and the surfaces shall

be regraded and rolled until it presents a reasonably smooth and even finish and is up to the required grade.

D. During hauling operations, all public and private roadway surfaces shall be kept clean and any topsoil or other dirt which may be brought upon the surface shall be removed promptly and thoroughly before it becomes compacted by traffic. If necessary, the wheels of all vehicles used for hauling shall be cleaned frequently and kept clean to avoid bringing any dirt upon the surface.

3.2 QUALITY CONTROL

A. The responsibility for satisfactory results on work carried out under this item rests entirely on the Contractor regardless of the prior approval of the materials and methods on the part of the Engineer or Agency Construction Coordinator.

B. The Contractor shall provide laboratory test results for the vegetative support material intended for use as specified herein, at a frequency of 1 round per 1,000 cy of material.

C. The Engineer or Agency Construction Coordinator shall randomly sample the borrow material and have a certified analytical laboratory perform testing as described herein. The testing shall be a verification of the results submitted by the Contractor and shall be entirely at the Contractor's expense.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Precast concrete manholes

2. Precast concrete catchbasins

3. Cast iron manhole frames and covers

4. Cast iron catchbasin frames and grates

B. Related Sections

1. Section 333114 – Testing of Sanitary Sewer and Storm Drainage Systems.

1.2 REFERENCES

A. AASHTO – American Association of State Highway and Transportation Officials, Standard Specifications for Highways and Bridges, most recent edition.

B. ASTM C32 - Standard Specification for Sewer and Manhole Brick (made from clay or shale).

C. ASTM A48 – Standard Specification for Gray Iron Castings.

D. ASTM C150 – Standard Specification for Portland Cement.

E. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.

G. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.

H. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.

I. ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.3 SUBMITTALS

A. Submit Shop Drawings, showing details of construction, reinforcing, joints, pipe connections to structures, manhole rungs, manhole frames and covers, dampproofing coating, catchbasin frames and grates.

B. Submit weights of manhole frames and covers and catchbasin frames and grates.

C. Submit design calculations including verification of adequate anti-flotation features and lateral earth pressures. Calculations shall verify that the manhole structure has been designed to withstand the burial depth, submergence due to flooding, flotation, and dead and live loads.

1.4 QUALITY ASSURANCE

A. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Agency. Such inspection may be made at the place of manufacture or at the Site after delivery, or at both places, and the materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. Materials which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, at no additional cost to the State.

B. At the time of inspection, the materials will be carefully examined for compliance with the latest ASTM designation specified and these Specifications, and with the approved manufacturer's drawings. Manhole sections will be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, and soundness. The surface shall be dense and close-textured.

C. Imperfections in manhole sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs will be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days, when tested in 3 inch by 6 inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

D. Personnel shall have confined space entry training as appropriate for the work to be performed.

E. Manholes and catchbasins shall be designed for lateral earth pressures and to resist flotation.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLE AND CATCHBASIN SECTIONS

A. Precast concrete barrel sections and transition top sections, shall conform to ASTM C478 and the following requirements:

1. The wall thickness shall not be less than 5 inches for 48 inch diameter reinforced barrel sections, 6 inches for 60 inch diameter reinforced barrel sections and 7 inches for 72 inch diameter reinforced barrel sections.

2. Top sections shall be eccentric except that flat top sections shall be used where shallow cover requires a top section less than 4 feet as shown on the Drawings.

3. Barrel sections shall have tongue and groove joints.

4. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.

5. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of AASHTO HS20-44 loading plus the weight of the soil above at 120 pcf.

6. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on each precast section.

7. Precast concrete bases shall be monolithically constructed. The thickness of the bottom slab of the precast bases shall not be less than the barrel sections or top slab whichever is greater. Precast concrete bases shall be constructed with a 6 inch extended base, unless otherwise shown on the Drawings.

8. Knock out panels for piping shall be provided in precast sections at the locations shown on the Drawings. They shall be integrally cast with the section, 2½ inches thick and shall be sized as shown on the Drawings. There shall be no steel reinforcing in knock out panels.

9. The side wall height of the base section shall be a minimum of 12 inches above the top of the pipe coming into the manholes and catchbasins.

10. A 2’-0” deep sump shall be provided below catchbasin outlet pipes.

2.2 BRICK MASONRY

A. Bricks shall be good, sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture. Underburned or salmon brick will not be acceptable and only whole brick shall be used unless otherwise permitted. In case bricks are rejected by the Engineer or Agency Construction Coordinator, they shall be immediately removed from the site of the work and satisfactory bricks substituted, at no additional cost to the State.

1. Bricks for the channels and shelves shall comply with the latest specifications of ASTM C32 for Sewer Brick, Grade SM.

2. Bricks for building up and leveling manhole frames shall conform to ASTM C32 Grade MS.

3. Poured concrete inverts will not be allowed.

B. Mortar used in the brickwork shall be composed of one part Type II portland cement conforming to ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs. to each bag of cement shall be added.

C. Sand used shall be washed, cleaned, screened, sharp and well graded as to different sizes and with no grain larger than will pass a No. 4 sieve. Sand shall be free from vegetable matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.

D. Hydrated lime shall conform to ASTM C207, Type S.

2.3 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30B.

B. Manhole covers shall have a diamond pattern, pickholes and the word "SEWER" or “DRAIN”, as appropriate, cast in 3 inch letters. Manhole frame and covers shall be manufactured by LeBaron Foundry; Mechanics Iron Foundry; Neenah Foundry or approved equal. Manholes located within Camp Niantic shall conform to CTARNG standards.

C. Manhole frames and covers shall comply with the detail shown on the Drawings.

D. Contractor shall set manholes frames and covers and yard drain frame and grates centered on the precast opening. If any manhole frames and covers or yard drain

frame and grates are found not to be centered on the precast opening at any time during construction, the Contractor will be required to perform all work necessary to center the frame and cover at no additional cost and to the satisfaction of the Agency Construction Coordinator.

E. Manhole frame and covers and yard drain frames and grates shall be set on brick (or precast) risers, minimum 2 courses of brick up to a maximum height of 18” from precast concrete structure to top of cover/grate. Higher riser sections are not acceptable; frames set directly on precast concrete structures are not acceptable.

F. Contractor shall install manhole steps in accordance with latest OSHA requirements. Top step shall be placed 4” below frame, bottom step to be placed a maximum of 16” above manhole invert. Intermediate step spacing shall be 12” max and each step shall be aligned directly above or below the previous and following step. Steps that are not aligned are not acceptable and the Contractor will remove and reset the misaligned steps at no additional cost and to the satisfaction of the Agency Construction Coordinator.

2.4 CATCHBASIN FRAMES AND GRATES

A. Catchbasin frames and grates shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Grate and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30B.

B. The catchbasin frames and grates shall comply with the details shown on the Drawings and the landscape drawings.

2.5 JOINTING PRECAST MANHOLE SECTIONS

A. Tongue and groove joints of precast manhole sections shall be sealed with a preformed flexible joint sealant. The preformed flexible joint sealant shall conform to ASTM C990.

2.6 MANHOLE RUNGS

A. Manhole rungs shall be drop front design, 14 inches wide with an abrasive step surface, steel reinforced, copolymer, polypropylene, plastic. Manhole rungs shall conform to OSHA requirements.

2.7 FLEXIBLE PIPE-TO-STRUCTURE CONNECTORS

A. The flexible pipe-to-structure connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.

B. The flexible boot shall be manufactured of EPDM synthetic rubber in accordance with ASTM C443 and C923 and shall be 3/8 inch thick or greater.

C. The external bands shall be made entirely of 304 series non-magnetic stainless steel.

D. The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.

E. The flexible connectors shall meet the following criteria, in accordance with ASTM C923:

1. Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.

2. Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.

3. Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

2.8 DAMPPROOFING

A. Provide two coats of bituminous dampproofing on outer surfaces of precast manholes at the rate of 20-25 square feet per gallon in accordance with manufacturer's instructions.

B. Dampproofing coating shall be a factory-applied asphalt compound specially made to adhere to below grade concrete structures.

C. The dampproofing shall be Sonoshield semi-mastic, as manufactured by BASF; Dehydratine 4 by Euclid Chemical; RIW Marine Liquid by Toch Brothers; or approved equal.

2.9 NON-SHRINK, WATER-PROOF GROUT

A. Non-shrink, water-proof grout shall be Hallemite; Waterplug; Embeco; or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation

1. Construct manholes and catchbasins to the dimensions shown on the Drawings and as specified. Protect all work against flooding and flotation.

2. Set precast concrete barrel sections so as to be plumb and with sections in true alignment with a ¼ inch maximum tolerance to be allowed.

3. Install the precast sections in a manner that will result in a watertight joint. Seal the joints of precast concrete barrel sections with the preformed flexible joint sealant used in sufficient quantity to fill 75% of the joint cavity. Fill the outside and inside precast section joints with non-shrink grout and finish flush with the adjoining surfaces. Plug holes in the concrete barrel sections required for handling or other purposes with a non-shrink, water-proof grout or concrete and rubber plugs, and finish flush on the inside.

4. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides.

B. Pipe Connections

1. Stubs

a. Connect pipe stubs for future extensions to the structures as shown on the Drawings and close the stub end by a suitable watertight plug.

2. For pipes with smooth exterior surfaces (PVC, ductile iron, HDPE pressure pipe, steel, etc), use flexible pipe-to-structure connectors.

3. Where flexible pipe-to-structure connectors cannot be used, such as pipes with rough, irregular or corrugated exterior surfaces (concrete, corrugated metal, HDPE drainage pipe, etc):

a. After the new pipe has been set in place, completely fill the hole around the new pipe and structure with non-shrink, water-proof grout.

b. Place a 6 inch thick concrete encasement a total of 12 inches in length around the pipe stub adjacent to the exterior wall of the structure. Concrete shall have a 28 day compressive strength of 3,000 psi.

C. Manhole Rung Installation

1. Steel reinforced copolymer polypropylene plastic steps shall be press fitted by hand driven hammer into preformed holes in cured precast sections, on 12 inch centers, by the precast concrete manufacturer.

D. Brickwork

1. Mix mortar only in such quantity as may be required for immediate use and use before the initial set has taken place. Do not retain mortar for more than one and one-half hours and constantly work over with a hoe or shovel until used.

Anti-freeze mixtures will not be allowed in the mortar. No masonry shall be laid when the outside temperature is below 40°F unless provisions are made to protect the mortar, bricks, and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The Engineer's decision as to the adequacy of protection against freezing shall be final.

2. Construct channels and shelves of brick as shown on the Drawings. The brick channels shall correspond in shape with the lower half of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped 1 inch per foot to drain toward the flow through channel. Construct brick surfaces exposed to sewage flow with the nominal 2 inch by 8 inch face exposed (i.e., bricks on edge).

3. Set manhole covers and frames and catchbasin frames and grates in a full mortar bed and bricks, a maximum of 12 inches thick for conical tops and 6 inches thick for flat top sections, utilized to assure frame and cover are set to the existing grade. Reset the manhole frames and covers and catchbasin frames and grates to final grade prior to placement of final paving.

3.2 LEAKAGE TEST

A. Leak test sewer manholes in conjunction with the pipeline in accordance with Section 333114.

3.3 CLEANING

A. Clean new manholes and catchbasins of silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Underground Warning Tape

1.2 SUBMITTALS

A. Shop Drawing Submittals

1. Product Data

PART 2 PRODUCTS

2.1 MATERIALS

A. Metallic warning tape for underground piping shall be polyethylene tape with metallic core for easy detection and location of piping with a metal detector.

B. Tape shall be 6 inches wide.

C. Tape shall be as manufactured by Seton Name Plate Corp., New Haven, CT; Presco Detectable Underground Warning tape, Sherman, Texas; Blackburn Manufacturing, Neligh, NE; Mercotape, Hachensach, NJ; or approved equal.

D. The warning tape shall be heavy gauge 0.004 inch polyethylene and shall be resistant to acids, alkalis and other soil components. It shall be highly visible in the following colors with the associated phrases stamped in black letters and repeated at a maximum interval of 40 inches.

Type of Utility	Color	Warning Message
Sanitary Sewer	Green	CAUTION - SANITARY SEWER BURIED BELOW
Storm Drain	Green	CAUTION - STORM DRAIN BURIED BELOW
Water	Blue	CAUTION – WATER LINE BURIED BELOW
Electric	Red	CAUTION – ELECTRIC LINE BURIED BELOW
Telephone / Communications	Orange	CAUTION – TELEPHONE LINE BURIED BELOW
Gas	Yellow	CAUTION – GAS LINE BURIED BELOW

E. The tape shall be of the type specifically manufactured for marking and locating utilities.

PART 3 EXECUTION

3.1 INSTALLATION

A. All buried pipe and fittings shall be installed with metallic-lined underground warning tape located approximately 18 inches below grade to allow detection by a metal detector.

END OF SECTION