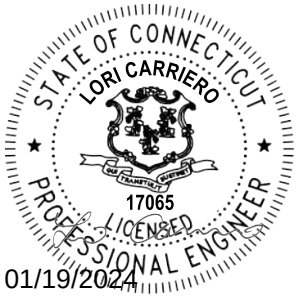
Project Manual

Town of Vernon

Exit 67
Sanitary Sewer Extension
Town Bid #2135

01/18/2024



01/19/2024

January 2024

Tighe&Bond
1000 Bridgeport Avenue, Suite 320
Shelton, CT 06484

Town of Vernon Exit 67 Sanitary Sewer Extension
Contract No. 2135
Vernon, Connecticut

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TOWN OF VERNON WATER POLLUTION CONTROL AUTHORITY

VERNON, CONNECTICUT

ADVERTISEMENT FOR BIDS

Sealed Bids for the construction of the "Town of Vernon Exit 67 Sewer Extension, Town Contract No. 2135 will be received by the Office of the Town Administrator, 14 Park Place, 3rd Floor Vernon, CT 06066 until 2:00 p.m. local time on February 15, 2024 at which time the Bids received will be publicly opened and read. Two hard copies and one electronic copy on a USB flash drive of the bid shall be submitted in a sealed envelope. Sealed Bids must have outer envelope marked as "Contract No. 2135 - Town of Vernon Exit 67 Sewer Extension." Emailed, faxed, or late bids will not be accepted.

The work consists of the installation of approximately 5,600 linear feet of 8" new gravity sewer main, approximately 1,200 linear feet of 6" new sewer service laterals, approximately 2,100 linear feet of 6" sewer force main, and 1 new pump station. Bids shall be on a lump sum and unit price basis as indicated in the Bid Form.

Bidding Documents may be obtained electronically from the Tighe & Bond website at: http://www.tighebond.com/Projects_Out_to_Bid.php

Prospective bidders must complete a one-time registration process on the web site in order to receive log-in credentials. Bidders must log in to the web site to download bidding documents for the project. Bidders will be added to the "planholders" or prospective bidders list upon downloading the bidding documents for the project.

Bidding documents may also be examined at the office of Tighe & Bond, Inc., 1000 Bridgeport Avenue, Shelton, CT between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday, legal holidays excluded. Questions for this bid will be received via the Tighe & Bond website no later than 7 days prior to the bid opening.

A bid deposit shall be furnished in accordance with the Instructions to Bidders.

Bidders shall be Department of Administrative Services (DAS) pre-qualified under the category of either "Water and Sewer Lines" or "Site Work". Bidders are advised that both the DAS Prequalification Certificate and Update (Bid) Statement must accompany the Bid proposal for projects estimated to exceed $500,000 under C.G.S. 4b-91 as amended. Failure to supply these forms with the Bid will result in rejection of the Bid.

TOWN OF VERNON, CONNECTICUT

Consulting Engineer:

Tighe & Bond, Inc.

1000 Bridgeport Avenue, Suite 320

Shelton, CT 06484

END OF SECTION

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SECTION 00200

INSTRUCTIONS TO BIDDERS

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ARTICLE 1 DEFINED TERMS

1.1 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions.

ARTICLE 2 COPIES OF BIDDING DOCUMENTS

2.1 Refer to Advertisement for Bids for information on examination and procurement of documents.

2.2 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.3 Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 QUALIFICATIONS OF BIDDERS

3.1 Bidders shall be experienced in the kind of Work to be performed, shall have the necessary equipment, and shall possess sufficient capital to properly execute the Work within the time allowed. Bids received from Bidders who have previously failed to complete Work within the time required, or who have previously performed similar Work in an unsatisfactory manner, may be rejected. A Bid may be rejected if Bidder cannot show that he has the necessary ability, plant and equipment to commence the Work at the time prescribed and thereafter to prosecute and complete the Work at the rate or within the time specified. A Bid may be rejected if Bidder is already obligated for the performance of other Work which would delay the commencement, prosecution or completion of the Work.

3.2 Bidders may be investigated by Owner to determine if they are qualified to perform the Work. All Bidders shall be prepared to submit within five days of Owner's or Engineer's request, written evidence of such information and data necessary to make this determination. The investigation of a Bidder will seek to determine whether the organization is adequate in size, is authorized to do business in the jurisdiction where the project is located, has had previous experience and whether available equipment and financial resources are adequate to assure Owner that the Work will be completed in accordance with the terms of the Agreement. Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of such Bidder fails to satisfy Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein.

A. Bidders may be required to provide a letter stating that the Bidder is in good financial standing. The letter must:

1. Be provided by a financial institution or certified public accountant having a relationship with the Bidder;

2. Be on the bank or accountant's letterhead;

3. Include name and contact information for the bank or accountant including address, email and telephone number;

4. Identify the account holder(s), whose names must match the name of the Bidder, the type and length of business relationship, and the historical status of the accounts (i.e. good standing, timely payments, no overdrafts, etc.); and NOT include account numbers, account amounts, or lines of credit.

B. Within three days of Owner's or Engineer's request, the Bidder shall submit 5 years of audited financial statements.

3.3 Bidders shall be Department of Administrative Services (DAS) pre-qualified under the category of either "Water and Sewer Lines" or "Site Work". Bidders are advised that both the DAS Prequalification Certificate and Update (Bid) Statement must accompany the bid proposal for projects estimated to exceed $500,000, and which is funded in whole or in part with state funds, except a public highway or bridge project or any other construction project administered by the Department of Transportation. Failure to supply these forms with the bid will result in rejection of the bid.

3.4 Any bid, from a Bidder who is on a U.S. Government and/or State of Connecticut Debarred Contractor List, will be rejected by the Owner in accordance with State and Federal Laws and Regulations.

ARTICLE 4 SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.1 The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment are to be obtained and paid for by Contractor.

4.2 Existing Site Conditions

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.

b. those drawings known to Owner of physical conditions in or relating to existing surface and subsurface structures at the Site (except Underground Facilities).

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Copies of reports and drawings referenced above will be made available for review at Engineer's office. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in paragraph 5.06 of the General Conditions.

4.3 Site Visit and Testing by Bidders

A. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

B. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

C. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

D. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.4 Owner's Safety Program

A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.5 Other Work at the Site

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work for which a Bid is to be submitted. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 BIDDER'S REPRESENTATIONS

5.1 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, including any Addenda, data, and referenced items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, or performance of the Work;

D. carefully study all reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or adjacent to the Site which have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and carefully study all reports and drawings relating to a Hazardous Environmental Condition, if any, at or adjacent to the Site which have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on 1) the cost, progress, and performance of the Work; 2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, , and 3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times and in accordance with the other terms and conditions of the Bidding Documents;

G. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

H. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and finishing of the Work; and

I. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 INTERPRETATIONS AND ADDENDA

6.1 All questions about the meaning or intent of the Bidding Documents shall be submitted in writing to the Engineer via the Tighe & Bond website for bidding document distribution at:

http://www.tighebond.com/Projects_Out_to_Bid.php

6.2 Prospective bidders must be registered users of the web site to submit questions regarding the project. In order to receive consideration, questions must be received by Engineer at least five days prior to the date fixed for the opening of Bids. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda to all parties recorded by Engineer as having received the Bidding Documents not later than three days prior to the date fixed for the opening of Bids. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6.3 Addenda may be issued to clarify, correct, supplement or change the Bidding Documents. Such Addenda, if any, will be issued in the manner and within the time period stated in paragraph 7.2.

6.4 The Bidder must acknowledge receipt of each Addendum, if any, in the space provided on the Bid Form.

ARTICLE 7 BID DEPOSIT

7.1 In the Bidding Documents, the terms "Bid security" and "Bid deposit" shall have the same meaning.

7.2 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5% of Bidder's maximum Bid price (including any additive alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

7.3 All Bid deposits of General Bidders, except those under consideration by Owner, will be returned within 5 days, excluding Saturdays, Sundays and legal holidays, after the opening of General Bids. Other Bid deposits will be returned upon the execution and delivery of the Agreement. The Bid deposit of the Successful Bidder will be retained until such bidder has furnished the required contract security and executed the Agreement, whereupon the bid deposit shall be returned. If the Successful Bidder fails to furnish the required contract security and execute the Agreement within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid deposit of that Bidder will be forfeited to Owner as liquidated damages for such failure.

ARTICLE 8 CONTRACT TIMES

8.1 The number of days within which, or the dates by which, the Work is to be:

A. substantially completed, and/or

B. completed and ready for final payment

are set forth in the Agreement.

ARTICLE 9 LIQUIDATED DAMAGES

9.1 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10 SUBSTITUTE AND "OR EQUAL" ITEMS

10.1 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or equal" items. In cases in which the

Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the effective date of the Contract.

ARTICLE 11 SUBCONTRACTORS, SUPPLIERS, AND OTHERS (NOT USED)

ARTICLE 12 PREPARATION OF BID

12.1 A Bid must be made on the Bid form included with the Project Manual. The Bid form shall not be altered in any way.

12.2 The Bid form must be completed in ink. Blank spaces in the Bid form must be filled in correctly where indicated, and the Bidder must state, both in words and numerals, the prices for which he proposes to complete each and every item of Work. Ditto marks shall not be used.

12.3 A Bidder shall execute his Bid as stated below.

A. A Bid by an individual shall show the Bidder's name and official address.

B. A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature) accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

C. A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature) and must be accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the corporate secretary. The state of incorporation and the official corporate address shall be shown.

D. A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

E. A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

F. All names must be printed in ink below the signature.

12.4 The Bid shall contain an acknowledgment of the receipt of all Addenda in the space provided on the Bid form.

12.5 Postal and email addresses and telephone number to which communications regarding the Bid are to be directed shall be shown.

12.6 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

12.7 In order to be considered for selection, the Bidder must submit a complete bid package in accordance with these Bidding Documents. Partial Bids will not be accepted. Refer to the Bid Form for a list of documents that shall be submitted in addition to the Bid Form.

12.8 Any deviations in completion of the Bid Form and accompanying documents from the instructions provided in this Article may be cause for rejection of the Bid.

ARTICLE 13 BASIS OF BID

13.1 Unit Price

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

D. Unit prices for identical item numbers that are in more than one bid schedule shall be equal. Discrepancies will be resolved in favor of the lowest unit price.

E. The award will be based on the lowest eligible Bid.

ARTICLE 14 SUBMITTAL OF BID

14.1 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title, the name and address of Bidder, and shall be accompanied by the Bid deposit and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "BID ENCLOSED". When using the mail or other delivery system, the Bidder is totally responsible for the mail or other delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bids. A mailed Bid shall be addressed to Owner at the address in the Advertisement for Bids.

14.2 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15 MODIFICATION OR WITHDRAWAL OF BID

15.1 Withdrawal Prior to Bid Opening

A. A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.2 Modification Prior to Bid Opening

A. If a Bidder wishes to modify its Bid prior to the Bid opening, Bidder must withdraw its initial Bid in the manner specified in paragraph 16.1.A and submit a new Bid prior to the date and time for the opening of Bids.

ARTICLE 16 OPENING OF BIDS

16.1 Bids will be opened as indicated in the Advertisement for Bids and publicly read aloud.

16.2 In order to be considered for selection, Bids must arrive at the designated location on or before the date and time specified in the Advertisement for Bids. Bidders mailing their Bids should allow for normal mail delivery time to ensure timely receipt of their Bids by Owner.

16.3 Bids received by mail or otherwise after the time specified for the opening of Bids will not be accepted and will be returned to the Bidder unopened.

16.4 No responsibility will attach to Owner, its employees or the Engineer for premature opening of a Bid not properly addressed and identified in accordance with the Bidding Documents.

ARTICLE 17 DISQUALIFICATION OF BIDDERS

17.1 More than one Bid for the same Work from an individual, or a firm, partnership, corporation or an association under the same or different names will not be considered. Reasonable grounds for believing that any Bidder is interested in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder is interested.

ARTICLE 18 BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.1 All Bids will remain subject to acceptance for the period of time stated in the Bid form, but Owner may, in its sole discretion, release any Bid and return the Bid deposit prior to the end of this period.

ARTICLE 19 EVALUATION OF BIDS AND AWARD OF CONTRACT

19.1 Owner reserves the right to reject any and all Bids, to waive any and all informalities, and the right to disregard all nonconforming, nonresponsive or conditional Bids.

19.2 Owner reserves the right to reject any Bid not accompanied by specified documentation and Bid deposit.

19.3 Owner reserves the right to reject any Bid if it shows any omissions, alterations of form, additions not called for, conditions or qualifications, or irregularities of any kind.

19.4 Owner reserves the right to reject any Bid that, in his sole discretion, is considered to be unbalanced or unreasonable as to the amount bid for any lump sum or unit price item.

19.5 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.6 In evaluating whether a Bidder is responsible, Owner will consider the qualifications the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.7 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

19.8 If the Owner awards the Contract for the Work, such award shall be to the responsible Bidder (who has neither been disqualified nor rejected pursuant to Article 18 or this Article 20) submitting the lowest responsive Bid.

19.9 Contents of the Bid of the Successful Bidder will become part of any contract awarded.

ARTICLE 20 CONTRACT SECURITIES

20.1 Performance and payment bonds shall be furnished by the successful Bidder. The amounts of and other requirements for performance and payment bonds are stated in Article 6 of the General Conditions. Performance and payment bonds submitted shall be posted by a recognized surety company having a place of business in the State of Connecticut. All performance and payment bonds signed by an agent must be accompanied by a certified copy of the authority to act. Performance Bonds and Payment Bonds shall be submitted on the forms included in Sections 00610 and 00615, respectively, of the Contract Documents. Additional requirements may be stated in the General or Supplementary Conditions.

20.2 Within 15 days from the date of the Notice of Award, the Successful Bidder shall deliver to Owner and Engineer, for review and approval, the performance bond and the payment bond he proposes to furnish at the time of the execution of the Agreement.

20.3 The required contract securities will become part of the Contract Documents.

ARTICLE 21 CONTRACT INSURANCE

21.1 The requirements for insurance to be provided by the Successful Bidder are stated in Article 6 of the General Conditions and in the Supplementary Conditions.

21.2 Within 15 days from the date of the Notice of Award, the Successful Bidder shall deliver evidence of required insurance to Owner and Engineer. The required insurance certificates will become part of the Contract Documents.

ARTICLE 22 SIGNING OF AGREEMENT

22.1 The Owner will transmit the required number of unsigned Agreements to the Successful Bidder with the Notice of Award. Within 15 days of the date of the Notice of Award, the Successful Bidder shall sign the Agreements and return them to the Owner. The Owner will return one executed Contract to the Successful Bidder.

ARTICLE 23 SALES TAXES

23.1 Owner is exempt from Connecticut State sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes shall not be included in the Bid. The exemption certificate will be provided to the Successful Bidder.

ARTICLE 24 CONNECTICUT PREVAILING WAGE RATES

24.1 Minimum Wage Rates as determined by the Connecticut State Labor Commissioner as required under Section 31-53(g) of the Connecticut General Statutes] as amended, apply to this project unless the total Bid is less than $400,000 for new construction or $100,000 for remodeling, refinishing, refurbishing, rehabilitation, alteration or repair projects. The Wage Rate Determination is included in Part II of the Supplementary Conditions.

24.2 It is the responsibility of the Bidder before bid opening to request any additional information on Minimum Wage Rates for those tradespeople who may be employed for the proposed Work under this Contract.It is the responsibility of the Bidder to obtain work classifications not included in the Wage Decisions package.

END OF SECTION

SECTION 00300

GEOTECHNICAL DATA

PART 1 GENERAL

1.1 SUMMARY

A. For the preparation of Bidding Documents, Engineer has relied upon the following reports and tests of subsurface and latent physical conditions of the site. The location of all bore holes is shown on the Drawings.

1. Soil boring data (attached)

a. The subsurface data are not guaranteed as to accuracy or completeness, nor are they a part of the Contract Documents.

b. Bidders are cautioned that the subsurface data have been utilized for general design purposes only. No explicit or implicit representation is made as to the nature of the materials which may be encountered below the surface of the ground.

c. The making available of this subsurface data to Bidders is not intended to relieve them from their responsibility to familiarize themselves with the subsurface and other site conditions.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

Jaime Lloret	**TEST BORING REPORT**	SHEET 1 OF 1	
DRILLER	**ASSOCIATED BORINGS CO., INC.**		
Brian Gaulzetti	**119 MARGARET CIRCLE, NAUGATUCK, CT 06770**	CME-45B	
INSPECTOR	**Tel (203) 729-5435 Fax (203) 729-5116**	DRILLING EQUIPMENT	
	PROJECT NAME: Exit 67 Sewer improvements	Tighe and Bond, Inc.	
DATE; 8/18/2020	PROJECT NUMBER:	CLIENT	
	LOCATION: Vernon, Connecticut		

POWER DRILL SOUNDING REPORT

Station	Offset	Elev	Probe #	From	To	Remarks: Soil Encountered, Groundwater Depth, Refusal Etc.
			B-67-1	0.0	0.0	Off Road
				0.0	7.0	Soil
						End of Boring - 7.0 G.W.O. - None
			B-67-2	0.0	0.0	Off Road
				0.0	12.0	Soil
						End of Boring - 12.0 G.W.O. - 11.0
			B-67-3	0.0	4"	Bituminous Concrete
				4"	12.0	Soil
						End of Boring - 12.0 G.W.O. - 11.0
			B-67-4	0.0	4"	Bituminous Concrete
				4"	11.0	Soil
						End of Boring - 11.0 G.W.O. - None
			B-67-5			DELETED ON GREEN ROAD
			B-67-6	0.0	0.0	Off Road
				0.0	8.0	Soil
						End of Boring - 8.0 G.W.O. - None
			B-67-7	0.0	2"	Bituminous Concrete
				2"	12.0	Soil
						End of Boring - 12.0 G.W.O. - 10.0
			B-67-8	0.0	0.0	Off Road
				0.0	8.0	Soil
						End of Boring - 8.0 G.W.O. - 4.0
			B-67-9	0.0	0.0	Off Road
				0.0	10.0	Soil
						End of Boring - 10.0 G.W.O. - 5.0
			B-67-10	0.0	4"	Bituminous Concrete
				4"	10.0	Soil
						End of Boring - 10.0 G.W.O. - None
			B-67-11	0.0	3"	Bituminous Concrete
				3"	14.5	Soil
						Refusal - 14.5 End of Boring - 14.5 G.W.O. - None
	5'SW		B-67-11A	0.0	3"	Bituminous Concrete
				3"	22.0	Soil
						End of Boring - 22.0 G.W.O. - None
			B-67-12	0.0	3"	Bituminous Concrete
				3"	13.0	Soil
						End of Boring - 13.0 G.W.O. - 10.0
			B-67-13	0.0	3"	Bituminous Concrete
				3"	10.0	Soil
						End of Boring - 10.0 G.W.O. - None
			B-67-14	0.0	3"	Bituminous Concrete
				3"	8.0	Soil
						End of Boring - 8.0 G.W.O. - None
			B-67-15	0.0	3"	Bituminous Concrete
				3"	9.0	Soil
						End of Boring - 9.0 G.W.O. - None

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

Tighe&Bond
Engineers | Environmental Specialists

Boring No. **B-1**
Page 1 of 1
File No. C-5081-002
Checked by: B. Opp

Project: Child Guidance Center of Southern CT
Location: 103 West Broad Street, Stamford, CT
Client: Child Guidance Center of Southern CT

Drilling Co.: General Borings Inc.
Foreman: J. Casson
T&B Rep.: C. Watts
Date Start: 09/20/22 End: 09/20/22
Location See Exploration Location Plan
GS. Elev. 55' Datum: NAVD 88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	3-1/4" I.D.	1-3/8"/2"
Hammer Wt.	-	140#
Hammer Fall	-	30"
Rig Make/Model	Diedrich D50	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
9/20	1220	11.2'	23.2'	35 min

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1 / 18	0-2	6-7	-	1" TOPSOIL over 17" Brown, fine to coarse SAND, little Silt	0.1' TOPSOIL		
				8-15					
		S-2 / 19	2-4	28-35	-	Very dense, brown, fine to coarse SAND and GRAVEL, little Silt	FILL		
				76-68					
5		S-3 / 17	5-7	7-14	-	4" Gray, fine to coarse SAND and GRAVEL, little Silt, little Concrete, trace Brick over 13" Brown, fine to medium SAND, some Silt, trace Gravel	5.3'		
				10-17					
		S-4 / 20	7-9	14-12	-	Medium dense, brown, fine to coarse SAND, little Silt, trace Gravel			
				13-13					
		S-5 / 13	9-11	14-21	-	Dense, brown, fine to medium SAND, little Gravel, little Silt			
10				26-35			GLACIAL TILL		
		S-6 / 24	11-13	10-13	-	Dense, brown, fine to coarse SAND, little Gravel, trace Silt			
				22-38					13.2'
15		S-7 / 0	15-17	22-33	-	No recovery, weathered bedrock in sampler tip			
				30-56			17'		
									PVC SCREEN
20		S-8 / 7	20-20.6	52-76/1"	-	Very dense, gray, WEATHERED SCHIST, wet	WEATHERED SCHIST		
									23.2'
25		S-9 / 2	25-25.2	50/2"	-	Very dense, gray, WEATHERED SCHIST, wet			
						Boring Terminated at 25.2 feet			
30									

Notes:
1. Samples taken with split spoon sampler driven by an autohammer.
2. Borehole backfilled with soil cuttings upon completion.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

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Boring No. **B-1A**
Page 1 of 1
File No. C-5081-002
Checked by: B. Opp

Project: Child Guidance Center of Southern CT
Location: 103 West Broad Street, Stamford, CT
Client: Child Guidance Center of Southern CT

Drilling Co.: General Borings Inc.
Foreman: J. Casson
T&B Rep.: C. Watts
Date Start: 09/20/22 End: 09/20/22
Location See Exploration Location Plan
GS. Elev. 55' Datum: NAVD 88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	3-1/4" I.D.	1-3/8"/2"
Hammer Wt.	-	140#
Hammer Fall	-	30"
Rig Make/Model	Diedrich D50	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1 / 13	0-2	7-10	-	Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt, dry	0.1' TOPSOIL		No Well Installed
				10-16					
		S-2 / 17	2-4	17-28	-	9" Brown, fine to coarse SAND, some Gravel, trace Silt, trace Brick over 8" Gray, fine to coarse GRAVEL and SAND, little Concrete, trace Silt	FILL		
				27-38					
5		S-3 / 11	4-6	19-16	-	Dense, gray, fine to medium SAND and GRAVEL, little Concrete, little Silt			
				20-46					
		S-4 / 17	6-8	23-18	-	6" Gray, fine to coarse SAND and GRAVEL, some Silt over 11" Brown, fine to coarse SAND, some Gravel, little Silt	6.5'		
				15-16					
		S-5 / 13	8-10	18-13	-	Medium dense, brown, fine to coarse SAND, some Gravel, little Silt	GLACIAL TILL		
				16-17					
10		S-6 / 18	10-12	15-23	-	Dense, brown, fine to medium SAND, some Silt, trace Gravel			
				14-25					
						Boring Terminated at 12 feet			
15									
20									
25									
30									

Notes:
1. Samples taken with split spoon sampler driven by an autohammer.
2. Borehole backfilled with soil cuttings upon completion.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

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Boring No. **B-2**
Page 1 of 1
File No. C-5081-002
Checked by: B. Opp

Project: Child Guidance Center of Southern CT
Location: 103 West Broad Street, Stamford, CT
Client: Child Guidance Center of Southern CT

Drilling Co.: General Borings Inc.
Foreman: J. Casson
T&B Rep.: C. Watts
Date Start: 09/20/22 End: 09/20/22
Location See Exploration Location Plan
GS. Elev. 56' Datum: NAVD 88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	3-1/4" I.D.	1-3/8"/2"
Hammer Wt.	-	140#
Hammer Fall	-	30"
Rig Make/Model	Diedrich D50	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
See Note 3				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1 / 20	0-2	4-8	-	6" TOPSOIL over 17" Brown, fine to coarse SAND, some Gravel, little Silt	0.5' TOPSOIL		
				8-16					
		S-2 / 15	2-4	14-5	2.2	Medium dense, brown, fine to medium SAND, some Silt, little Gravel, trace Roots	FILL		
				6-4	0.6				
		S-3 / 16	4-6	6-11	-	Medium dense, brown, fine to coarse SAND, some Silt, trace Gravel			
5				15-14			6'		
		S-4 / 20	6-8	12-13	1.1	Medium dense, brown, fine to coarse SAND, some Silt, little Gravel			
				16-17					
		S-5 / 10	8-10	9-14	0.9	Dense, brown, fine to coarse SAND, little Gravel, little Silt	GLACIAL TILL		No Well Installed
				20-37					
10		S-6 / 17	10-12	10-16	0.5	Dense, orange to brown, fine to coarse SAND, some Silt, little Gravel			
				32-100			12'		
							WEATHERED SCHIST		
15		S-7 / 3	15-15.3	100/3"	-	Very dense, gray, WEATHERED SCHIST, wet			
						Auger Refusal at 17.5 feet		2	
20									
25									
30									

Notes:
1. Samples taken with split spoon sampler driven by an autohammer.
2. Borehole backfilled with soil cuttings upon completion.
3. Groundwater was observed at 15 feet while drilling.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

15 Boring Locations: B67-1 to B67-15
164' of Borings
(Assuming no auger refusals/bedrock)

B67-1
7' Deep; On Road

B67-10
10' Deep; On Road

B67-4
11' Deep; On Road

B67-2
12' Deep; On Road

B67-5
10' Deep; On Road

B67-3
12' Deep; On Road

B67-6
8' Deep; On Road

B67-7
12' Deep; On Developed Road Entrance

B67-8
8' Deep; Off Road; Caution of Culvert & SD Pipes

B67-9
10' Deep; Off Road; Caution of Culvert & SD Pipes

B67-13
10' Deep; NW Corner of Park & Ride Parking Lot

B67-15
9' Deep; On Road

B67-11
22' Deep; On Road; Caution of Culvert

B67-14
10' Deep; On Road

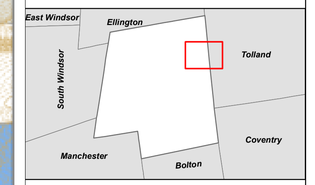
B67-12
13' Deep; Off Park & Ride Entrance

FIGURE 6-2: EXIT 67 SOIL BORING LOCATIONS

LEGEND

- Proposed Manhole
- Proposed Pump Station
- Pump Station
- Gravity Main
- Proposed Force Main
- Low Pressure Sewer
- Gravity Main (Base Layout)
- Proposed Force Main (Base Layout)
- Existing Sewer Main
- Existing Force Main
- Waterbody
- Building Footprint
- Existing Lot Area of Study (50 Parcels)
- Proposed Additional Area of Study for Existing Lot (110 Parcels)
- Proposed Lot Area of Study for Development (5 Parcels)
- Approximate Parcel Boundary

LOCUS MAP



N W E S

0 250 500
Feet

1:3,000

NOTES

Exit 66/67 Sanitary Sewer Feasibility Study
Vernon, Connecticut

December 2020

Tighe&Bond

G:\GIS\CT\VernonCT\arcproj\Exit_66&67_Layouts\Update_20201012\Exit67_Layout3B.mxd Date Saved: 12/23/2020 User: AFreudenberg

V-0037

SECTION 00410

BID FORM

PROJECT IDENTIFICATION:

Town of Vernon Exit 67 Sewer Extension – Town Contract No. 2135

TABLE OF ARTICLES

1. Bid Recipient
2. Bidder's Acknowledgements
3. Bidder's Representations
4. Bidder's Certifications
5. Basis of Bid
6. Time of Completion
7. Attachments to This Bid
8. Bid Submittal

ARTICLE 1 - BID RECIPIENT

1.1 This Bid is submitted to:

Town of Vernon Office of the Town Administrator

14 Park Place

Vernon, CT 06066

1.2 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGEMENTS

2.1 Bidder accepts all of the terms and conditions of the Advertisement for Bids and Instructions to Bidders, including without limitation, those dealing with the disposition of Bid deposit. The Bid will remain subject to acceptance for 30 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.1 In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents and hereby acknowledges the receipt of all Addenda.

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

K. Bidder is aware that the estimated quantities on the Bid Form are subject to Article 13.03 of the General Conditions (Section 00700).

ARTICLE 4 - BIDDER'S CERTIFICATION

4.1 Bidder certifies that, under penalty of perjury, Bidder is not presently debarred from doing public construction work in the State of Connecticut under the provisions of Section 31-53a of the Connecticut General Statutes or any other applicable debarment provisions of any other chapter of the General Statutes or any rule or regulation promulgated thereunder; and is not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

4.2 Bidder hereby certifies under the penalties of perjury, to the best of Bidder's knowledge and belief, that Bidder has filed all State tax returns and paid all State taxes required by law.

4.3 Bidder certifies that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

4.4 Bidder certifies that Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

4.5 Bidder certifies that Bidder has not solicited or induced any individual or entity to refrain from bidding; and

4.6 Bidder certifies that Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph:

A. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

B. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of the Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

C. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

D. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 - BASIS OF BID

5.1 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Item Number	Item Name and Unit Bid Prices Written in Words and Figures	Estimated Quantity	Total Amount of Item (in figures)
1	Mobilization and Demobilization, per lump sum, the price of: _____ ($) *Not to exceed 5 percent of the total Base Bid price	lump sum* =	$_____
2	Traffic Control, per lump sum, the price of: _____ ( )	lump sum =	$_____
3	Sediment and erosion control, per lump sum, the price of: _____ ($)	x lump sum =	$_____
4	Test Pits, per cubic yard, the price of: _____ ($)	x 50 CY =	$_____
5	Excavation Below Normal Grade – Unsuitable Material, per cubic yard, the price of: _____ ($)	x 50 CY =	$_____
6	Miscellaneous Concrete, per cubic yard, the price of: _____ ($)	x 10 CY =	$_____
7	Rock Excavation, per cubic yard, the price of: _____ ($)	x 25 CY =	$_____

8	Crushed Stone Bedding, per cubic yard, the price of:		
	_____	x 50 CY =	$_____
	($)		
9	Ordinary Borrow, per cubic yard, the price of:		
	_____	x 50 CY =	$_____
	($)		
10	8-inch PVC Gravity Sewer Main, less than 10' deep, per linear foot, the price of:		
	_____	x 4,160 LF =	$_____
	($)		
10A	8-inch PVC Gravity Sewer Main, 10-15' deep, per linear foot, the price of:		
	_____	x 800 LF =	$_____
	($)		
10B	8-inch PVC Gravity Sewer Main, >15' deep, per linear foot, the price of:		
	_____	x 460 LF=	$_____
	($)		
11	Sewer Manholes, less than 10' deep, per each, the price of:		
	_____	x 19 each =	$_____
	($)		
11A	Sewer Manholes, 10-15' deep, per each, the price of:		
	_____	x 4 each =	$_____
	($)		

11B Sewer Manholes, >15' deep, per each, the price of:

_____ x 3 each = $_____

($)

12 Modifications to existing manhole, per each, the price of:

_____ x 3 each = $_____

($)

13 Existing sewer and manhole cleaning and inspection, per lump sum, the price of:

_____ x lump sum = $_____

($)

14 6-inch PVC sewer laterals, per linear foot, the price of:

_____ x 1,200 LF = $_____

($)

15 6-inch ductile iron Force Sewer Main, per linear foot, the price of:

_____ x 2,100 LF = $_____

($)

16 Asphalt Concrete Curb, per linear foot, the price of:

_____ x 3,700 LF = $_____

($)

17 Bituminous Concrete Driveway and Sidewalk Repair, per square yard, the price of:

_____ x 1,000 SY = $_____

($)

18	Bank Run Gravel Subbase, per cubic yard, the price of: _____ ($)	x 50 CY =	$_____
19	Processed Aggregate Subbase, per cubic yard, the price of: _____ ($)	x 210 CY =	$_____
20	State Road Temporary Bituminous Concrete Pavement Repair, 4" Superpave 0.5, per ton, the price of: _____ ($)	x 830 tons =	$_____
21	Local Road Temporary Bituminous Concrete Pavement Repair, 2" Superpave 0.375, per ton, the price of: _____ ($)	x 220 tons =	$_____
22	State Road Permanent Bituminous Concrete Pavement Trench Repair, One 3" Course Superpave 1.0, per ton, the price of: _____ ($)	x 1,540 tons =	$_____
23	State Road Permanent Bituminous Concrete Pavement Trench Repair, Two 1 ½" Course Superpave 0.5, per ton, the price of: _____ ($)	x 770 tons =	$_____

24 Local Road Permanent Bituminous Concrete Pavement Trench Repair, One 2" Course Superpave 0.375, per ton, the price of:

x 300 tons = $_____

_____

($)

25 Local Road Permanent Bituminous Concrete Pavement Trench Repair, One 2" Course Superpave 0.5, per ton, the price of:

x 300 tons = $_____

_____

($)

26 Permanent Bituminous Concrete Repair: 2" milling, State and local roads, per square yard, the price of:

_____ x 11,600 SY = $_____

($)

27 Permanent Bituminous Concrete Repair: 2" Superpave 0.5 overlay, State and Local Roads, per ton, the price of:

_____

x 1,330 tons = $_____

($)

28 Gravel Road Repair, per square yard, the price of:

_____

x 820 SY = $_____

($)

29 Site Restoration, per lump sum, the price of:

_____

x lump sum = $_____

($)

30 Pump Station, per lump sum, the price of:

_____

x lump sum = $_____

($)

31 Pump Station, utility allowance, the price of:

Thirty Thousand

($ 30,000) Allowance = $ 30,000

32 Allowance for the use of Certified Flaggers for Traffic Control on State Roads, the price of:

One Hundred Fifty Thousand

Allowance = $ 150,000

($ 150,000)

TOTAL AMOUNT OF BID – Items 1 through 32

_____ dollars
(words)

($_____)

(figures)

5.2 This Bid includes Addenda numbered _____.

ARTICLE 6 - TIME OF COMPLETION

6.1 Bidder agrees that the Work will be substantially completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.2 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times as stated in the Agreement.

ARTICLE 7 - ATTACHMENTS TO THIS BID

7.1 The following documents are attached to and made a condition of this Bid:

A. Bid deposit in the amount of _____ dollars ($_____), consisting of a bid bond in the amount of five percent of the total amount of Bid

B. Evidence of authority to sign

C. List of Project References

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids

E. A list of adversarial proceedings in which the bidder is or was a party within the past 5 years that relate to the procurement or performance of any public or private construction contract together with a brief statement as to outcome if concluded or status if pending.

F. A list of any projects on which the firm was terminated or failed to complete the work within the past 5 years, including a brief explanation for each instance listed.

G. Evidence of Bidder's qualifications in accordance with Article 3 of Section 00200

BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

Bidder's License No.: _____
(where applicable)

END OF SECTION

J:\V\V0037 Vernon WWTP\017 - Exit 67 Sewer Extension Design\Design\Specifications\Div 0\00410-Bid Form.docx

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name— Include Location)*:

BOND

Bond Number:

Date:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00520

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

This Agreement is by and between the Town of Vernon, hereinafter called Owner and _____ hereinafter called Contractor.

Owner and Contractor hereby agree as follows:

ARTICLE 1 WORK

1.1 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described with the following title: "Town of Vernon Exit 67 Sewer Extension - Town Contract No. 2135.

ARTICLE 2 ENGINEER

2.1 The part of the Project that pertains to the Work has been designed by Tighe & Bond, Inc

2.2 The Owner has retained Tighe & Bond ("Engineer") to act as Owner's representative, assuming all duties and responsibilities, rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 3 CONTRACT TIMES

3.1 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

3.2 Substantial Completion and Final Payment

A. The Work will be substantially completed within 365 days from the date of the Notice to Proceed and completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions within 400 days from the date of the Notice to Proceed.

3.3 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 3.1 above and that Owner will suffer financial and other losses if the Work is not completed within the times specified in Paragraph 3.2 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner $2,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 3.1 above for Substantial Completion until the Work is substantially complete.

2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time (as duly adjusted pursuant to the Contract), for completion and readiness for final payment, Contractor shall pay Owner $2,000 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

ARTICLE 4 CONTRACT PRICE

4.1 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount equal to the prices stated in Contractor's Bid, attached hereto as an exhibit, subject to adjustment under the Contract.

4.2 The total amount will be adjusted by measurement of actual installed quantities in strict conformity with the provisions contained herein.

ARTICLE 5 PAYMENT PROCEDURES

5.1 Applications for Payment shall be processed in accordance with Article 15 of the General Conditions.

5.2 Owner shall make progress payments on account of the Contract Price on the basis of processed Applications for Payment monthly during construction, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All progress payments will be measured by the Schedule of Values established as provided in the General Conditions, or in the event there is no schedule of values, as provided elsewhere in the Contract.

5.3 Owner shall retain from progress payments 5 percent of the value of Work completed.

5.4 Substantial Completion

A. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to ninety-nine percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

5.5 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 6 CONTRACTOR'S REPRESENTATIONS

6.1 Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 7 CONTRACT DOCUMENTS

7.1 Contents

A. The Contract Documents consist of the following:

1. This Agreement (pages 00520-1 to 00520-7, inclusive);
2. Performance Bond (pages 1 to 3, inclusive);
3. Payment Bond (pages 1 to 3, inclusive);
4. General Conditions (title pages, table of contents, and pages 1 to 65, inclusive);
5. Supplementary Conditions (pages 00800-1 to 00800-8, inclusive);

6. Specifications (Divisions 1 through 16);

7. Addenda (numbers _____ to _____, inclusive);

8. Exhibits to this Agreement (enumerated as follows):

   a. Contractor's Bid (pages 00410-1 to 00410-11, inclusive);

9. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:

   a. Notice to Proceed;

   b. Work Change Directives;

   c. Change Order(s);

   d. Field Orders

B. The documents listed in Paragraph 7.1.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 8 MISCELLANEOUS

8.1 Terms

A. Terms used in this Agreement will have the meanings indicated in the General Conditions and the Supplementary Conditions.

8.2 Assignment of Contract

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

8.3 Successors and Assigns

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

8.4 Severability

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

8.5 Contractor Certifications

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.5:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.6 Other Provisions

A. Owner stipulates that the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and Owner has plainly shown all modifications to the standard wording of such published document to the Contractor in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. This Agreement will be effective on _____, _____ (which is the Effective Date of the Contract).

OWNER:

_____

By: _____

Title: _____

[CORPORATE SEAL]

Attest _____

Title: _____

Address for giving notices:

_____

_____

_____

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution of other documents authorizing execution of Owner-Contractor Agreement.)

CONTRACTOR:

_____

By: _____

Title: _____

[CORPORATE SEAL]

Attest _____

Title: _____

Address for giving notices:

_____

_____

_____

License No. _____
(Where applicable)

(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

Certified as to the availability of funds:

_____

Date

_____

Signed

_____

Title

END OF SECTION

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

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11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

    5.1 Claimants who do not have a direct contract with the Contractor,

        5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2 Pay or arrange for payment of any undisputed amounts.

    7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the

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Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer

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has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

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24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or "RPR" includes any assistants or field staff of Resident Project Representative.

33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals and the performance of related construction activities.

35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*:

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).

E. *Furnish, Install, Perform, Provide*:

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

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3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

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3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or

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computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict,

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error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

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3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

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2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.

E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.

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G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*:

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part

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by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or

2. is of such a nature as to require a change in the Drawings or Specifications; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

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c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice as required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after

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becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Possible Price and Times Adjustments*:

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

    d. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

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5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

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F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

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ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is

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maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

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4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

a. Such insurance shall be maintained for three years after final payment.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result

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of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

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6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

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5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
6. extend to cover damage or loss to insured property while in transit.
7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
8. allow for the waiver of the insurer's subrogation rights, as set forth below.
9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
10. not include a co-insurance clause.
11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
12. include performance/hot testing and start-up.
13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

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6.06 *Waiver of Rights*

A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the

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policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and

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guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) it has a proven record of performance and availability of responsive service; and

4) it is not objectionable to Owner.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

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D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

a. shall certify that the proposed substitute item will:

1) perform adequately the functions and achieve the results called for by the general design,

2) be similar in substance to that specified, and

3) be suited to the same use as that specified.

b. will state:

1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

c. will identify:

1) all variations of the proposed substitute item from that specified, and

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2) available engineering, sales, maintenance, repair, and replacement services.

d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.

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E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

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O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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7.09 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

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2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or

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exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

1. Before submitting a Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.

1. *Shop Drawings*:

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

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provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. *Samples*:

   a. Contractor shall submit the number of Samples required in the Specifications.

   b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

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8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.

E. *Resubmittal Procedures*:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

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D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop

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Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

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D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

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9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during

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or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

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B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

2. *Work Change Directives*: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an

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adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

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the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

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the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

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B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

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submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable

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thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes

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other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

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cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

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B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

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include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

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a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

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e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount

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remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

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E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of

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inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

   d. a list of all disputes that Contractor believes are unsettled; and

   e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation,

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including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses,

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and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for

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expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

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18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00800

SUPPLEMENTARY CONDITIONS

PART 1 AMENDMENTS TO GENERAL CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2013 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

The address system used in the Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 Delete paragraph 1.01A.38 in its entirety and insert the following in its place:

1.01A.38. Specifications – Sections included under Division 1 through Division 16 of the Project Manual.

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 Delete paragraph 2.02A in its entirety.

ARTICLE 3 –DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.01 Replace paragraph 3.01E with the following paragraph:

3.01E In the event of conflicts, inconsistencies or discrepancies among the Contract Documents, to the extent applicable, the better quality or greater quantity of work shall be provided without change to the Contract Price. In the event of such conflicts, inconsistencies or discrepancies which do not relate to the quality or quantity of work, the Contractor shall request clarifications or interpretations from the Engineer as provided herein.

SC-3.01 Add the following new paragraph immediately after paragraph 3.01E:

3.01F Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 Delete paragraph 4.01A in its entirety and insert the following in its place:

4.01A The Contract Times will commence to run on the date specified in the Notice to Proceed.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 Add the following new paragraphs immediately after paragraph 5.03B.3:

5.03C In the preparation of Drawings and Specifications, Engineer has relied upon the data obtained from tests of subsurface and latent physical conditions of the site. Such data is in the form of boring logs which are included in the Project Manual. The approximate location of the test borings are shown on the Drawings and in Section 00300. Such logs and samples are not part of the Contract Documents.

5.03C.1 The subsurface data are not guaranteed as to accuracy or completeness.

5.03C.2 Bidders are cautioned that the subsurface data have been utilized for general design purposes only. No explicit or implicit representation is made as to the nature of the materials which may be encountered below the surface of the ground.

5.03C.3 The making available of this subsurface data to Bidders is not intended to relieve them from their responsibility to familiarize themselves with subsurface and other site conditions.

Add the following new paragraphs immediately after paragraph 5.06A.2:

5.06A.3 The following reports regarding Hazardous Environmental Conditions at the Site are known to the Owner. Copies of these items may be examined are included in the Specifications. Such items are not part of the Contract Documents.

5.06A.3.a The Report dated October 5, 2022 prepared by Phoenix Environmental Laboratories, Inc., consisting of 48 pages. The technical data contained in such documents upon which Contractor may rely is soil test results.

ARTICLE 6 - BONDS AND INSURANCE

SC-6.03 Add the following new paragraph immediately after paragraph 6.03B.3:

6.03B.4 Insurance certificate(s) shall also contain the following:

1. Confirmation that the General Liability policy covers only the Work under this Contract, with project specific limits.
2. Confirmation that automobile insurance covers all Scheduled, Hired and Non-Owned vehicles.
3. Names of all additional insureds as specified herein.

SC-6.03 Add the words "and Paragraph 6.04" after the words "Paragraph 6.03" in Paragraph 6.03I.

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

6.03.K The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall be in accordance with the limits shown on the document entitled "Town of Vernon Insurance Requirements" attached to the end of this section.

SC -6.05 Delete Section 6.05 in its entirety and insert the following in its place:

6.05 Not used.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

SC-7.02 Add the following new paragraph immediately after paragraph 7.02B.

7.02C Whenever Owner shall notify Contractor in writing that any person on the Work appears to be incompetent, disorderly, or otherwise unsatisfactory, such person shall be removed from the Project and shall not again be employed on it except with the consent of Owner.

SC-7.07 Delete paragraph 7.07B in its entirety and replace it with the following:

7.07B Not used.

SC-7.08 Delete the word "Owner" in the last sentence of Paragraph 7.08A and replace with the word "Contractor."

SC-7.09 Add the following sentence at the end of paragraph 7.09.A.

All materials provided under this Contract are exempt from the Sales and Use Taxes of the State of Connecticut. The tax exemption number will be provided to the Contractor.

SC-7.18 Add the following new paragraph immediately after paragraph 7.18.C.

7.18D If, through acts of neglect on the part of Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the Work, Contractor shall settle with such other Contractor or Subcontractor by agreement or arbitration if such other Contractor or Subcontractor will so settle. If such other Contractor or Subcontractor shall assert any claim against Owner on account of any such damage alleged to have been sustained, Owner shall notify Contractor, who shall indemnify, defend, and save harmless Owner against any such claim.

SC-8.01 Add the following new paragraph immediately after paragraph 8.01.D:

8.01E Contractor is notified that water main replacement work is expected to be taking place within the project area by the Connecticut Water Company. Specific scheduling of such work will be discussed at the preconstruction meeting. Contractor will need coordinate the sewer main construction work with the water main replacement work. The Owner reserves the right to negotiate a change in the pavement replacement work once a formal schedule for the water main replacement has been confirmed.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

SC-9.02 Eliminate "provided Contractor makes no reasonable objection to the replacement engineer" from the first sentence.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:

B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

1. RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
8. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

SC-11.06 Insert the following sentence at the end of Paragraph 11.06.A.2:

If Engineer does not take action on the Change Proposal and neither Owner nor Contractor submit a letter to the other party indicating that the Change Proposal is deemed denied, then the Change Proposal shall be deemed denied after 60 days of Engineer's receipt of the Contractor's supporting data, thereby commencing the time for appeal of the denial under Article 12.

ARTICLE 13 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.01 Delete the word "superintendents," in the second sentence after the word "limitation," in paragraph 13.01B.1.

SC-13.01 Delete paragraph 13.01B.5.c in its entirety and replace with the following:

13.01B.5.c The fair rental and operating cost of all machinery and equipment used on the extra work for the period of such use. The fair rental and operating cost for all machinery and equipment shall be based upon the most recent edition of "Rental Rate Bluebook for Construction Equipment" (the "Bluebook"), published by Equipment Watch (equipmentwatch.com), or a similar publication approved by Engineer and adjusted for regional and age adjustments as specified in the "Bluebook." Rental periods corresponding to the overall period of use shall be used, except if a piece of equipment used on extra work is already on the job, or has previously been rented for a long period of time (months), then the long-term rental rate (monthly) shall be used in determining costs. The hourly rental rate for long-term rental equipment will be determined by the monthly rental rate divided by 176.

For the situation where equipment is on the job and available for use but cannot be used due to a delay or suspension of a portion or all of the Contract activities, a rental standby rate may be paid if the Contractor can conclusively demonstrate to the satisfaction of the Engineer that: (1) the equipment cannot be used elsewhere on the Project or demobilized and remobilized at a cost lower than the cost of standby time, (2) that the equipment cannot be put in use due to factors beyond the Contractor's control, and (3) the equipment on standby would have been used as part of the Work that is suspended or put on hold. The standby rate will be calculated as no more than 50% of the rental rate as listed in the "Bluebook" and adjusted for regional and age adjustments. Lesser standby rates may apply if the Owner or Engineer can demonstrate that the Contractor's standby cost is less than this rate. The standby rate will not include operating costs. A standby rate will not be paid for equipment which is being employed for portions of the Work which are still underway. A standby rate will also not be paid for equipment which is readily demobilized including construction equipment categorized as "shop tools" or "miscellaneous" in the "Bluebook." Standby rates for durations of less than four hours will not be considered.

SC-13.01 Insert in the first sentence after the word "architects," the word "superintendents," in paragraph 13.01C.1

SC-13.01 Add the following new paragraph immediately after paragraph 13.01C.5:

13.01C.6 Costs of or rental of small tools; costs of or rental of buildings.
13.02C Not used.

SC-13.03 Delete Paragraph 13.03B in its entirety and replace it with the following:

13.03B Since subject to change upon determination of actual quantities, estimated quantities of items of Unit Price Work are not guaranteed and serve to facilitate comparison of Bids and to determine an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

ARTICLE 14 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-14.02 Insert after the word "notice" the words "(minimum 24 hours)" in paragraph 14.02A.

SC-14.03 Delete paragraph 14.03B in its entirety and replace with the following:

14.03B *Engineer's Authority:* At any time during the progress of the Work, Engineer shall have the authority to determine whether Work is defective,

and reject defective Work, even though such work has been previously inspected and paid for.

SC-14.06 Add the following new paragraph immediately after paragraph 14.06A.

14.06B If Owner stops work under Paragraph 14.06, Contractor shall not be entitled to an extension of Contract Time nor to an increase in Contract Price.

ARTICLE 15 - PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.01 Delete the first sentence of paragraph 15.01B.1 and replace with the following:

15.01B.1 Engineer will, once in each month, make an estimate in writing of the total value of the work completed as of the date of the Application. Engineer shall review the Application with Contractor, and Contractor shall sign the Application.

SC-15.01 Insert the following sentence at the end of paragraph 15.01B.1: The Certificate of Insurance for stored materials must list Tighe & Bond and the Town of Vernon as additional insureds.

SC-15.01 Delete paragraph 15.01D.1 in its entirety and insert the following in its place:

15.01D.1 Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

SC-15.03 Delete the second sentence in Paragraph 15.03A in its entirety.

SC-15.03 Delete paragraph 15.03C in its entirety and insert the following in its place:

15.03C If, after consultation with Owner, Engineer considers and the Owner agrees that the Work is substantially complete, Engineer will prepare and deliver to Contractor, in a form approved by Owner, a Certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be included with the certificate a list of items to be completed or corrected before final payment.

SC-15.03 Delete the word "preliminary" from paragraph 15.03D.

SC-15.04 Add the following new paragraph immediately after paragraph 15.04A.3:

15.04A.4 Owner may at any time request Contractor in writing to permit Owner to take over operation of any part of the Work although it is not substantially complete. A copy of such request will be sent to Engineer, and within a reasonable time thereafter Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by Owner, Engineer will finalize the list of items to be completed or corrected and will deliver such lists to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties, and guarantees for that part of the Work which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior

to Substantial Completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

Paragraph 15.04.A.4 shall be renumbered to 15.04.A.5

SC-15.06 Delete paragraph 15.06.D in its entirety and insert the following in its place:

D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, or other time period in accordance with applicable laws and regulations, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

SC- 16.02 Add the following new paragraph immediately after paragraph 16.02.A.4:

16.02.A.5 If Contractor abandons the Work, or sublets this Contract or any part thereof, without the previous written consent of Owner, or if the Contract or any claim thereunder shall be assigned by Contractor otherwise than as herein specified.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-17.02 Add the following paragraph after paragraph 17.01:

17.02 Venue

A. Any suit by either party arising under this Contract shall be brought only in the Superior Court in the county where the Project is located. The parties hereto waive any argument that this venue is improper or that the forum is inconvenient.

ARTICLE 18 - MISCELLANEOUS

SC-18.08 Add the following new paragraphs immediately after paragraph 18.08.

18.09 Wage Rates

A. The requirements and provisions of all applicable laws and any amendments thereof or additions thereto as to the employment of labor, and to the schedule of minimum wage rates established in compliance with laws shall be a part of these Contract Documents. Copies of the wage schedules are included in Part II of these Supplementary Conditions. If it becomes necessary to employ any person in a trade or occupation not classified in the wage determinations, such person shall be paid at not less than such rates as shall be determined by the officials administrating the laws mentioned above. Such approved minimum rate shall be retroactive to the time of the initial employment of such person in such trade or occupation.

B. The schedules of wages referred to above are minimum rates only, and Owner will not consider any claims for additional compensation made by Contractor because of payment by Contractor of any wage rate in excess of the applicable rate contained in these Contract Documents. All disputes in regard to the payment of wages in excess of those specified in the schedules shall be resolved by Contractor. The said schedules of wages shall continue to be the minimum rates to be paid during the life of this Agreement and a legible copy of said schedules shall be kept posted in a conspicuous place at the site of the work.

Town of Vernon Insurance Requirements
Sewer Line Construction/Rehabilitation Project

Contractor shall agree to maintain in force at all times during the contract the following minimum coverages and shall name the Town of Vernon as an Additional Insured on a primary and non-contributory basis to all policies except Workers Compensation and Professional Liability. All policies shall include a Waiver of Subrogation. Insurance shall be written with Carriers approved in the State of Connecticut and with a minimum AM Best's Rating of "A-" VIII. In addition, all Carriers are subject to approval by the Town of Vernon.

		(Minimum Limits)
General Liability	Each Occurrence	$1,000,000
	General Aggregate	$2,000,000
	Products/Completed Operations Aggregate	$2,000,000
Auto Liability	Combined Single Limit Each Accident	$1,000,000
Umbrella (Excess Liability)	Each Occurrence Aggregate	$3,000,000 $3,000,000
Pollution Liability	Each Incident Aggregate	$1,000,000 $1,000,000
Professional Liability	Each Wrongful Act Aggregate	$1,000,000 $1,000,000

If any policy is written on a "Claims Made" basis, the policy must be continually renewed for a minimum of two (2) years from the completion date of this contract. If the policy is replaced and/or the retroactive date is changed, then the expiring policy must be endorsed to extend the reporting period for claims for the policy in effect during the contract for two (2) years from the completion date.

Workers' Compensation and	WC Statutory Limits	
Employers' Liability	EL Each Accident	$1,000,000
	EL Disease Each Employee	$1,000,000
	EL Disease Policy Limit	$1,000,000

Original, completed Certificates of Insurance must be presented to the Town of Vernon prior to contract issuance. Contractor agrees to provide replacement/renewal certificates at least 30 days prior to the expiration date of the policies.

END OF SECTION

ATTACHMENTS TO SUPPLEMENTARY CONDITIONS

ATTACHMENT A
CONNECTICUT STATE WAGE RATES

Minimum Rates and Classifications for Building Construction

ID#: 24-57150

Connecticut Department of Labor
Wage and Workplace Standards

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number: 2135 Project Town: Vernon
State#: FAP#:
Project: Exit 67 Sewer Extension

CLASSIFICATION	Hourly Rate	Benefits
1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.**See Laborers Group 7**		
1c) Asbestos Worker/Heat and Frost Insulator	45.56	32.65
2) Boilermaker	46.21	29.35
3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons	41.11	34.65 + a
3b) Tile Setter	37.1	30.52
3c) Tile and Stone Finishers	30.0	25.30
3d) Marble & Terrazzo Finishers	31.07	24.23
3e) Plasterer	42.77	29.63

------LABORERS------

4) Group 1: General laborers, carpenter tenders, concrete specialists, wrecking laborers and fire watchers.	33.5	25.59
4) Group 1a: Acetylene Burners (Hours worked with a torch)	34.5	25.59
4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman (Person running mixer and spraying fireproof only).	33.75	25.59
4b) Group 3: Jackhammer operators/pavement breaker, mason tender (brick), mason tender (cement/concrete), forklift operators and forklift operators (masonry).	34.0	25.59
4c) **Group 4: Pipelayers (Installation of water, storm drainage or sewage lines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary task is to actually perform the mating of pipe sections) P6 and P7 rate is $26.80.	34.5	25.59
4d) Group 5: Air track operator, sand blaster and hydraulic drills.	34.25	25.59
4e) Group 6: Blasters, nuclear and toxic waste removal.	36.5	25.59
4f) Group 7: Asbestos/lead removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped).	36.5	25.59
4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew.	31.78	25.59
4h) Group 9: Top men on open air caisson, cylindrical work and boring crew.	31.24	25.59
4i) Group 10: Traffic Control Signalman	20.1	25.59

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4j) Group 11: Toxic Waste Removers A or B With PPE	36.5	25.59
5) Carpenter, Acoustical Ceiling Installation, Soft Floor/Carpet Laying, Metal Stud Installation, Form Work and Scaffold Building, Drywall Hanging, Modular-Furniture Systems Installers, Lathers, Piledrivers, Resilient Floor Layers.	37.61	27.61
5a) Millwrights	40.56	28.87
6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	43.75	32.47+3% of gross wage
7a) Elevator Mechanic (Trade License required: R-1,2,5,6)	64.01	37.885+a+b
-----LINE CONSTRUCTION----		
Groundman	26.5	6.5% + 9.00
Linemen/Cable Splicer	48.19	6.5% + 22.00
8) Glazier (Trade License required: FG-1,2)	41.18	24.55 + a
9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection	42.37	40.02 + a
----OPERATORS----		
Group 1: Crane Handling or Erecting Structural Steel or Stone; Hoisting Engineer (2 drums or over). (Trade License Required)	52.78	27.80 + a
Group 1a: Front End Loader (7 cubic yards or over); Work Boat 26 ft. and Over	48.37	27.80 + a

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Group 2: Cranes (100 ton rate capacity and over); Bauer Drill/Caisson. (Trade License Required)	52.41	27.80 + a
Group 2a: Cranes (under 100 ton rated capacity).	51.51	27.80 + a
Group 2b: Excavator over 2 cubic yards; Pile Driver ($3.00 premium when operator controls hammer)	48.0	27.80 + a
Group 3: Excavator; Gradall; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Finegrade. (slopes, shaping, laser or GPS, etc.). (Trade License Required)	47.1	27.80 + a
Group 4: Trenching Machines; Lighter Derrick; CMI Machine or Similar; Koehring Loader (Skooper); Goldhofer.	46.64	27.80 + a
Group 5: Specialty Railroad Equipment; Asphalt Spreader, Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24 mandrel).	45.92	27.80 + a
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller.	45.92	27.80 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	45.55	27.80 + a
Group 7: Asphalt Roller; Concrete Saws and Cutters (ride on types); Vermeer Concrete Cutter; Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under mandrel).	45.14	27.80 + a
Group 8: Mechanic; Grease Truck Operator; Hydroblaster; Barrier Mover; Power Stone Spreader; Welding; Work Boat Under 26 ft.; Transfer Machine; Rigger Foreman.	44.67	27.80 + a
Group 9: Front End Loader (under 3 cubic yards); Skid Steer Loader regardless of attachments; (Bobcat or Similar); Forklift, Power Chipper; Landscape Equipment (including Hydroseeder); Vacuum Excavation	44.14	27.80 + a

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Truck and Hydrovac Excavation Truck (27 HG pressure or greater).		
Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc.	41.69	27.80 + a
Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.	41.69	27.80 + a
Group 12: Wellpoint Operator.	41.61	27.80 + a
Group 13: Compressor Battery Operator.	40.92	27.80 + a
Group 14: Elevator Operator; Tow Motor Operator (solid tire no rough terrain).	39.54	27.80 + a
Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	39.06	27.80 + a
Group 16: Maintenance Engineer.	38.28	27.80 + a
Group 17: Portable Asphalt Plant Operator; Portable Crusher Plant Operator; Portable Concrete Plant Operator; Portable Grout Plant Operator; Portable Water Filtration Plant Operator.	43.46	27.80 + a
Group 18: Power Safety Boat; Vacuum Truck; Zim Mixer; Sweeper; (Minimum for any job requiring a CDL license); Rigger; Signalman.	40.54	27.80 + a
------PAINTERS (Including Drywall Finishing)------		
10a) Brush and Roller	37.62	24.55
10b) Taping Only/Drywall Finishing	38.37	24.55

10c) Paperhanger and Red Label	38.12	24.55
10e) Blast and Spray	40.62	24.55
11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2)	48.28	35.50
12) Well Digger, Pile Testing Machine	37.26	24.05 + a
13) Roofer (composition)	41.8	22.65
14) Roofer (slate & tile)	42.3	22.65
15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6)	41.89	43.22
16) Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4, G-1, G-2, G-8 & G-9)	48.28	35.50
------TRUCK DRIVERS------		
17a) 2 Axle, Helpers	32.16	30.51 + a
17b) 3 Axle, 2 Axle Ready Mix	32.27	30.51 + a
17c) 3 Axle Ready Mix	32.33	30.51 + a
17d) 4 Axle	32.39	30.51 + a
17e) 4 Axle Ready Mix	32.44	30.51 + a

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17f) Heavy Duty Trailer (40 Tons and Over)	34.66	30.51 + a
17g) Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids)	32.44	30.51 + a
17h) Heavy Duty Trailer up to 40 tons	33.39	30.51 + a
17i) Snorkle Truck	32.54	30.51 + a
18) Sprinkler Fitter (Trade License required: F-1,2,3,4)	47.55	32.27 + a
19) Theatrical Stage Journeyman	25.76	7.34

Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

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The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

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

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: January 17, 2024

As of: January 17, 2024

Minimum Rates and Classifications for
Heavy/Highway Construction

ID#: 24-57150

Connecticut Department of Labor
Wage and Workplace Standards

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number: 2135 Project Town: Vernon
State#: FAP#:
Project: Exit 67 Sewer Extension

CLASSIFICATION	Hourly Rate	Benefits
1) Boilermaker	46.21	29.35
1a) Bricklayer, Cement Masons, Cement Finishers, Plasterers, Stone Masons	41.63	34.50
2) Carpenters, Piledrivermen	37.61	27.61
2a) Diver Tenders	37.61	27.61
3) Divers	46.07	27.61
03a) Millwrights	40.56	28.87
4) Painters: (Bridge Construction) Brush, Roller, Blasting (Sand, Water, etc.), Spray	56.25	25.15
4a) Painters: Brush and Roller	37.62	24.55
4b) Painters: Spray Only	40.62	24.55

As of: January 17, 2024

4c) Painters: Steel Only	39.62	24.55
4d) Painters: Blast and Spray	40.62	24.55
4e) Painters: Tanks, Tower and Swing	39.62	24.55
4f) Elevated Tanks (60 feet and above)	46.62	24.55
5) Electrician (Trade License required: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	43.75	32.47+3% of gross wage
6) Ironworkers: Ornamental, Reinforcing, Structural, and Precast Concrete Erection	42.37	40.02 + a
7) Plumbers (Trade License required: (P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2) and Pipefitters (Including HVAC Work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4 G-1, G-2, G-8, G-9)	48.28	35.50
----LABORERS---- -		
8) Group 1: General Laborers and concrete specialist	33.5	25.59
8) Group 1a: Acetylene Burners (Hours worked with a torch)	34.5	25.59
9) Group 2: Chain saw operators, fence and guard rail erectors, pneumatic tool operators, powdermen	33.75	25.59
10) Group 3: Pipelayers	34.0	25.59
11) Group 4: Jackhammer/Pavement breaker (handheld); mason tenders (cement/concrete), catch basin builders, asphalt rakers, air track operators, block paver, curb setter and forklift operators	34.0	25.59

As of: January 17, 2024

12) Group 5: Toxic waste removal (non-mechanical systems)	35.5	25.59
13) Group 6: Blasters	35.25	25.59
Group 7: Asbestos/lead removal, non-mechanical systems (does not include leaded joint pipe)	36.5	25.59
Group 8: Traffic control signalmen	20.1	25.59
Group 9: Hydraulic Drills	34.25	25.59
Group 10: Toxic Waste Removers A or B With PPE	36.5	25.59
----LABORERS (TUNNEL CONSTRUCTION, FREE AIR). Shield Drive and Liner Plate Tunnels in Free Air.----		
13a) Miners, Motormen, Mucking Machine Operators, Nozzle Men, Grout Men, Shaft & Tunnel Steel & Rodmen, Shield & Erector, Arm Operator, Cable Tenders	35.73	25.59 + a
13b) Brakemen, Trackmen, Miners' Helpers and all other men	34.76	25.59 + a
----CLEANING, CONCRETE AND CAULKING TUNNEL----		
14) Concrete Workers, Form Movers, and Strippers	34.76	25.59 + a
15) Form Erectors	35.09	25.59 + a
----ROCK SHAFT LINING, CONCRETE, LINING OF SAME AND TUNNEL IN FREE AIR:----		

16) Brakemen, Trackmen, Tunnel Laborers, Shaft Laborers, Miners Helpers	34.76	25.59 + a
17) Laborers Topside, Cage Tenders, Bellman	34.65	25.59 + a
18) Miners	35.73	25.59 + a
----TUNNELS, CAISSON AND CYLINDER WORK IN COMPRESSED AIR: ----		
18a) Blaster	42.22	25.59 + a
19) Brakemen, Trackmen, Groutman, Laborers, Outside Lock Tender, Gauge Tenders	42.02	25.59 + a
20) Change House Attendants, Powder Watchmen, Top on Iron Bolts	40.04	25.59 + a
21) Mucking Machine Operator, Grout Boss, Track Boss	42.81	25.59 + a
----TRUCK DRIVERS----(*see note below)		
Two Axle Trucks, Helpers	32.16	30.51 + a
Three Axle Trucks; Two Axle Ready Mix	32.27	30.51 + a
Three Axle Ready Mix	32.33	30.51 + a
Four Axle Trucks	32.39	30.51 + a
Four Axle Ready-Mix	32.44	30.51 + a

As of: January 17, 2024

Heavy Duty Trailer (40 tons and over)	34.66	30.51 + a
Specialized earth moving equipment other than conventional type on-the road trucks and semi-trailer (including Euclids)	32.44	30.51 + a
Heavy Duty Trailer (up to 40 tons)	33.39	30.51 + a
Snorkle Truck	32.54	30.51 + a
----POWER EQUIPMENT OPERATORS----		
Group 1: Crane Handling or Erecting Structural Steel or Stone, Hoisting Engineer (2 drums or over). (Trade License Required)	52.78	27.80 + a
Group 1a: Front End Loader (7 cubic yards or over); Work Boat 26 ft. and over.	48.37	27.80 + a
Group 2: Cranes (100 ton rate capacity and over); Bauer Drill/Caisson. (Trade License Required)	52.41	27.80 + a
Group 2a: Cranes (under 100 ton rated capacity).	51.51	27.80 + a
Group 2b: Excavator over 2 cubic yards; Pile Driver ($3.00 premium when operator controls hammer).	48.0	27.80 + a
Group 3: Excavator; Gradall; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade (slopes, shaping, laser or GPS, etc.). (Trade License Required)	47.1	27.80 + a
Group 4: Trenching Machines; Lighter Derrick; CMI Machine or Similar; Koehring Loader (Skooper).	46.64	27.80 + a
Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Spreader; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps;	45.92	27.80 + a

Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" mandrel)		
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller.	45.92	27.80 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	45.55	27.80 + a
Group 7: Asphalt Roller; Concrete Saws and Cutters (ride on types); Vermeer Concrete Cutter; Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under Mandrel)	45.14	27.80 + a
Group 8: Mechanic, Grease Truck Operator, Hydroblaster, Barrier Mover, Power Stone Spreader; Welder; Work Boat under 26 ft.; Transfer Machine.	44.67	27.80 + a
Group 9: Front End Loader (under 3 cubic yards), Skid Steer Loader regardless of attachments (Bobcat or Similar); Fork Lift, Power Chipper; Landscape Equipment (including hydroseeder), Vacuum Excavation Truck and Hydrovac Excavation Truck (27 HG pressure or greater).	44.14	27.80 + a
Group 10: Vibratory Hammer, Ice Machine, Diesel and Air Hammer, etc.	41.69	27.80 + a
Group 11: Conveyor, Earth Roller; Power Pavement Breaker (whiphammer), Robot Demolition Equipment.	41.69	27.80 + a
Group 12: Wellpoint Operator.	41.61	27.80 + a
Group 13: Compressor Battery Operator.	40.92	27.80 + a
Group 14: Elevator Operator; Tow Motor Operator (Solid Tire No Rough Terrain).	39.54	27.80 + a

As of: January 17, 2024

Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	39.06	27.80 + a
Group 16: Maintenance Engineer.	38.28	27.80 + a
Group 17: Portable Asphalt Plant Operator; Portable Crusher Plant Operator; Portable Concrete Plant Operator., Portable Grout Plant Operator, Portable Water Filtration Plant Operator.	43.46	27.80 + a
Group 18: Power Safety Boat; Vacuum Truck; Zim Mixer; Sweeper; (minimum for any job requiring CDL license).	40.54	27.80 + a

**NOTE: SEE BELOW

----LINE CONSTRUCTION----(Railroad Construction and Maintenance)----

20) Lineman, Cable Splicer, Technician	48.36	16.92
21) Heavy Equipment Operator	42.26	6.5% + 19.88
22) Equipment Operator, Tractor Trailer Driver, Material Men	40.96	6.5% + 19.21
23) Driver Groundmen	26.5	6.5% + 9.00
23a) Truck Driver	40.96	6.5% + 17.76

----LINE CONSTRUCTION----

24) Driver Groundmen	30.92	6.5% + 9.70
25) Groundmen	22.67	6.5% + 6.20

As of: January 17, 2024

26) Heavy Equipment Operators	37.1	6.5% + 10.70
27) Linemen, Cable Splicers, Dynamite Men	41.22	6.5% + 12.20
28) Material Men, Tractor Trailer Drivers, Equipment Operators	35.04	6.5% + 10.45

Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

~~Connecticut General Statute Section 31-55a: Annual Adjustments to wage rates by contractors doing state work ~~

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

As of: January 17, 2024

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

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

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: January 17, 2024

ATTACHMENT B
SOIL SAMPLING RESULTS

PHOENIX
Environmental Laboratories, Inc.

Wednesday, October 05, 2022

Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Project ID: VERNON PS EXIT 67
SDG ID: GCM35514
Sample ID#s: CM35514 - CM35518, CM35520

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

Enclosed are revised Analysis Report pages. Please replace and discard the original pages. If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac NY # 11301

SDG Comments

October 05, 2022

SDG I.D.: GCM35514

Version 2: Total and SPLP Pesticide analyses added per client request.

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

October 05, 2022

SDG I.D.: GCM35514

Project ID: VERNON PS EXIT 67

Client Id	Lab Id	Matrix
B-1 (0-2)	CM35514	SOIL
B-2 (0-2)	CM35515	SOIL
B-3 (0-2)	CM35516	SOIL
B-4 (0-2)	CM35517	SOIL
B-1 (4-6)	CM35518	SOIL
B-2 (6-8)	CM35520	SOIL

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/16/22	15:05
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35514

Project ID: VERNON PS EXIT 67
Client ID: B-1 (0-2)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Percent Solid	86		%		09/19/22	Q	SW846-%Solid
Soil Extraction for Pesticide	Completed				09/21/22	B/C	SW3545A
Pesticides							
4,4' -DDD	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
4,4' -DDE	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
4,4' -DDT	2.7	1.5	ug/Kg	2	09/22/22	AW	SW8081B
a-BHC	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
Alachlor	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Aldrin	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
b-BHC	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
Chlordane	ND	38	ug/Kg	2	09/22/22	AW	SW8081B
d-BHC	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
Dieldrin	ND	3.8	ug/Kg	2	09/22/22	AW	SW8081B
Endosulfan I	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Endosulfan II	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Endosulfan sulfate	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Endrin	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Endrin aldehyde	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Endrin ketone	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
g-BHC	ND	1.5	ug/Kg	2	09/22/22	AW	SW8081B
Heptachlor	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Heptachlor epoxide	ND	7.6	ug/Kg	2	09/22/22	AW	SW8081B
Methoxychlor	ND	38	ug/Kg	2	09/22/22	AW	SW8081B
Toxaphene	ND	150	ug/Kg	2	09/22/22	AW	SW8081B
QA/QC Surrogates							
% DCBP	60		%	2	09/22/22	AW	30 - 150 %

Ver 2

Project ID: VERNON PS EXIT 67
Client ID: B-1 (0-2)

Phoenix I.D.: CM35514

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
% DCBP (Confirmation)	48		%	2	09/22/22	AW	30 - 150 %
% TCMX	54		%	2	09/22/22	AW	30 - 150 %
% TCMX (Confirmation)	55		%	2	09/22/22	AW	30 - 150 %

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/19/22	14:55
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35515

Project ID: VERNON PS EXIT 67
Client ID: B-2 (0-2)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Silver	< 0.36	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Arsenic	1.30	0.72	mg/Kg	1	09/21/22	TH	SW6010D
Barium	47.4	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Beryllium	0.35	0.29	mg/Kg	1	09/21/22	TH	SW6010D
Cadmium	0.96	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Chromium	14.1	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Copper	15.1	0.7	mg/kg	1	09/21/22	TH	SW6010D
Mercury	< 0.03	0.03	mg/Kg	2	09/26/22	IE	SW7471B
Nickel	7.77	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Lead	15.6	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Antimony	< 3.6	3.6	mg/Kg	1	09/21/22	TH	SW6010D
Selenium	< 1.4	1.4	mg/Kg	1	09/21/22	TH	SW6010D
Thallium	< 3.2	3.2	mg/Kg	1	09/21/22	TH	SW6010D
Vanadium	25.1	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Zinc	24.2	0.7	mg/Kg	1	09/21/22	TH	SW6010D
Percent Solid	85		%		09/19/22	Q	SW846-%Solid
Soil Extraction for PCB	Completed				09/20/22	B/MO	SW3545A
Soil Extraction for Pesticide	Completed				09/20/22	B/MO	SW3545A
Field Extraction	Completed				09/19/22		SW5035A
Mercury Digestion	Completed				09/26/22	KL/AB	SW7471B
Extraction of ETPH	Completed				09/20/22	B/U	SW3546
Soil Extraction for SVOA	Completed				09/20/22	B/C	SW3546
SPLP Extraction for Organics	Completed				09/30/22	AB	SW1312
SPLP Pesticides Ext.	Completed				10/03/22	P	SW3510C
Total Metals Digest	Completed				09/19/22	M/AG	SW3050B

Project ID: VERNON PS EXIT 67
Client ID: B-2 (0-2)

Phoenix I.D.: CM35515

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
TPH by GC (Extractable Products)								
Ext. Petroleum H.C. (C9-C36)	ND	290	mg/Kg	5	09/22/22	JRB	CTETPH 8015D	
Identification	ND		mg/Kg	5	09/22/22	JRB	CTETPH 8015D	
QA/QC Surrogates								
% COD (surr)	40		%	5	09/22/22	JRB	50 - 150 %	3
% Terphenyl (surr)	58		%	5	09/22/22	JRB	50 - 150 %	
Polychlorinated Biphenyls								
PCB-1016	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1221	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1232	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1242	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1248	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1254	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1260	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1262	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1268	ND	390	ug/Kg	10	09/21/22	SC	SW8082A	
QA/QC Surrogates								
% DCBP	75		%	10	09/21/22	SC	30 - 150 %	
% DCBP (Confirmation)	80		%	10	09/21/22	SC	30 - 150 %	
% TCMX	87		%	10	09/21/22	SC	30 - 150 %	
% TCMX (Confirmation)	73		%	10	09/21/22	SC	30 - 150 %	
Pesticides								
4,4' -DDD	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
4,4' -DDE	2.8	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
4,4' -DDT	4.5	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
a-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Alachlor	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Aldrin	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
b-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Chlordane	ND	39	ug/Kg	2	09/21/22	AW	SW8081B	
d-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Dieldrin	9.6	3.9	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan I	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan II	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan sulfate	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin aldehyde	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin ketone	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
g-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Heptachlor	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Heptachlor epoxide	ND	7.7	ug/Kg	2	09/21/22	AW	SW8081B	
Methoxychlor	ND	39	ug/Kg	2	09/21/22	AW	SW8081B	
Toxaphene	ND	150	ug/Kg	2	09/21/22	AW	SW8081B	
QA/QC Surrogates								
% DCBP	77		%	2	09/21/22	AW	30 - 150 %	
% DCBP (Confirmation)	62		%	2	09/21/22	AW	30 - 150 %	
% TCMX	69		%	2	09/21/22	AW	30 - 150 %	

Ver 2

Project ID: VERNON PS EXIT 67
Client ID: B-2 (0-2)

Phoenix I.D.: CM35515

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
% TCMX (Confirmation)	67		%	2	09/21/22	AW	30 - 150 %
SPLP Pesticides							
4,4' -DDD	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
4,4' -DDE	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
4,4' -DDT	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
a-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Alachlor	ND	0.010	ug/L	1	10/04/22	AW	SW8081B
Aldrin	ND	0.003	ug/L	1	10/04/22	AW	SW8081B
b-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Chlordane	ND	0.050	ug/L	1	10/04/22	AW	SW8081B
d-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Dieldrin	0.009	0.002	ug/L	1	10/04/22	AW	SW8081B
Endosulfan I	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Endosulfan II	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Endosulfan sulfate	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Endrin	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Endrin aldehyde	ND	0.020	ug/L	1	10/04/22	AW	SW8081B
Endrin Ketone	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
g-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Heptachlor	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Heptachlor epoxide	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Methoxychlor	ND	0.005	ug/L	1	10/04/22	AW	SW8081B
Toxaphene	ND	0.20	ug/L	1	10/04/22	AW	SW8081B
QA/QC Surrogates							
%DCBP (Surrogate Rec)	36		%	1	10/04/22	AW	30 - 150 %
%DCBP (Surrogate Rec) (Confirmation)	42		%	1	10/04/22	AW	30 - 150 %
%TCMX (Surrogate Rec)	85		%	1	10/04/22	AW	30 - 150 %
%TCMX (Surrogate Rec) (Confirmation)	95		%	1	10/04/22	AW	30 - 150 %
Volatiles							
1,1,1,2-Tetrachloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,1-Trichloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,2,2-Tetrachloroethane	ND	3.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,2-Trichloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloroethene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloropropene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,3-Trichlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,3-Trichloropropane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,4-Trichlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,4-Trimethylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dibromo-3-chloropropane	ND	5.0	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dibromoethane	ND	0.55	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichloropropane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,3,5-Trimethylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,3-Dichlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
1,3-Dichloropropane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C

Project ID: VERNON PS EXIT 67
Client ID: B-2 (0-2)

Phoenix I.D.: CM35515

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,4-Dichlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
2,2-Dichloropropane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
2-Chlorotoluene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
2-Hexanone	ND	27	ug/Kg	1	09/20/22	JLI	SW8260C
2-Isopropyltoluene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
4-Chlorotoluene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
4-Methyl-2-pentanone	ND	27	ug/Kg	1	09/20/22	JLI	SW8260C
Acetone	ND	270	ug/Kg	1	09/20/22	JLI	SW8260C
Acrylonitrile	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Benzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Bromobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Bromochloromethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Bromodichloromethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Bromoform	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Bromomethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Carbon Disulfide	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Carbon tetrachloride	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Chlorobenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Chloroethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Chloroform	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Chloromethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
cis-1,2-Dichloroethene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
cis-1,3-Dichloropropene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Dibromochloromethane	ND	3.3	ug/Kg	1	09/20/22	JLI	SW8260C
Dibromomethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Dichlorodifluoromethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Ethylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Hexachlorobutadiene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Isopropylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
m&p-Xylene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Methyl Ethyl Ketone	ND	33	ug/Kg	1	09/20/22	JLI	SW8260C
Methyl t-butyl ether (MTBE)	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Methylene chloride	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Naphthalene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
n-Butylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
n-Propylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
o-Xylene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
p-Isopropyltoluene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
sec-Butylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Styrene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
tert-Butylbenzene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Tetrachloroethene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Tetrahydrofuran (THF)	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Toluene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Total Xylenes	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,2-Dichloroethene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,3-Dichloropropene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,4-dichloro-2-butene	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Trichloroethene	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Trichlorofluoromethane	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
Trichlorotrifluoroethane	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Vinyl chloride	ND	5.5	ug/Kg	1	09/20/22	JLI	SW8260C
QA/QC Surrogates							
% 1,2-dichlorobenzene-d4	96		%	1	09/20/22	JLI	70 - 130 %
% Bromofluorobenzene	100		%	1	09/20/22	JLI	70 - 130 %
% Dibromofluoromethane	94		%	1	09/20/22	JLI	70 - 130 %
% Toluene-d8	97		%	1	09/20/22	JLI	70 - 130 %
Semivolatiles							
1,2,4,5-Tetrachlorobenzene	ND	100	ug/Kg	1	09/21/22	WB	SW8270D
1,2,4-Trichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
1,2-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
1,2-Diphenylhydrazine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
1,3-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
1,4-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,2'-Oxybis(1-Chloropropane)	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4,5-Trichlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4,6-Trichlorophenol	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dichlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dimethylphenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrophenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,6-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2-Chloronaphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Chlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylnaphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylphenol (o-cresol)	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitrophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
3&4-Methylphenol (m&p-cresol)	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
3,3'-Dichlorobenzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
3-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4,6-Dinitro-2-methylphenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Bromophenyl phenyl ether	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloro-3-methylphenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloroaniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
4-Chlorophenyl phenyl ether	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitrophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthylene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acetophenone	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Aniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benz(a)anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(a)pyrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(b)fluoranthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(ghi)perylene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D

Project ID: VERNON PS EXIT 67
Client ID: B-2 (0-2)

Phoenix I.D.: CM35515

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Benzo(k)fluoranthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzoic acid	ND	760	ug/Kg	1	09/21/22	WB	SW8270D
Benzyl butyl phthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethoxy)methane	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethyl)ether	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-ethylhexyl)phthalate	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Carbazole	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Chrysene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Dibenz(a,h)anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Dibenzofuran	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Diethyl phthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Dimethylphthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-butylphthalate	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-octylphthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Fluoranthene	470	270	ug/Kg	1	09/21/22	WB	SW8270D
Fluorene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobutadiene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorocyclopentadiene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachloroethane	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Indeno(1,2,3-cd)pyrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Isophorone	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Naphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Nitrobenzene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodimethylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodi-n-propylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodiphenylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Pentachloronitrobenzene	ND	140	ug/Kg	1	09/21/22	WB	SW8270D
Pentachlorophenol	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Phenanthrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Phenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Pyrene	440	270	ug/Kg	1	09/21/22	WB	SW8270D
Pyridine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
QA/QC Surrogates							
% 2,4,6-Tribromophenol	66		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorobiphenyl	46		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorophenol	57		%	1	09/21/22	WB	30 - 130 %
% Nitrobenzene-d5	59		%	1	09/21/22	WB	30 - 130 %
% Phenol-d5	61		%	1	09/21/22	WB	30 - 130 %
% Terphenyl-d14	60		%	1	09/21/22	WB	30 - 130 %

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference

3 = This parameter exceeds laboratory specified limits.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

Per 1.4.6 of EPA method 8270D, 1,2-Diphenylhydrazine is unstable and readily converts to Azobenzene. Azobenzene is used for the calibration of 1,2-Diphenylhydrazine.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/19/22	14:25
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35516

Project ID: VERNON PS EXIT 67
Client ID: B-3 (0-2)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Silver	< 0.35	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Arsenic	1.27	0.69	mg/Kg	1	09/21/22	TH	SW6010D
Barium	37.0	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Beryllium	0.30	0.28	mg/Kg	1	09/21/22	TH	SW6010D
Cadmium	1.05	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Chromium	9.87	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Copper	13.2	0.7	mg/kg	1	09/21/22	TH	SW6010D
Mercury	< 0.03	0.03	mg/Kg	2	09/26/22	IE	SW7471B
Nickel	7.02	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Lead	9.58	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Antimony	< 3.5	3.5	mg/Kg	1	09/21/22	TH	SW6010D
Selenium	< 1.4	1.4	mg/Kg	1	09/21/22	TH	SW6010D
Thallium	< 3.1	3.1	mg/Kg	1	09/21/22	TH	SW6010D
Vanadium	32.1	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Zinc	23.1	0.7	mg/Kg	1	09/21/22	TH	SW6010D
Percent Solid	90		%		09/19/22	Q	SW846-%Solid
Soil Extraction for PCB	Completed				09/20/22	B/MO	SW3545A
Soil Extraction for Pesticide	Completed				09/20/22	B/MO	SW3545A
Mercury Digestion	Completed				09/26/22	KL/AB	SW7471B
Extraction of ETPH	Completed				09/20/22	B/U	SW3546
Soil Extraction for SVOA	Completed				09/20/22	B/C	SW3546
Total Metals Digest	Completed				09/19/22	M/AG	SW3050B

TPH by GC (Extractable Products)

Ext. Petroleum H.C. (C9-C36)	ND	81	mg/Kg	1	09/21/22	JRB	CTETPH 8015D
Identification	ND		mg/Kg	1	09/21/22	JRB	CTETPH 8015D

QA/QC Surrogates

Project ID: VERNON PS EXIT 67
Client ID: B-3 (0-2)

Phoenix I.D.: CM35516

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
% COD (surr)	47		%	1	09/21/22	JRB	50 - 150 %	3
% Terphenyl (surr)	58		%	1	09/21/22	JRB	50 - 150 %	
Polychlorinated Biphenyls								
PCB-1016	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1221	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1232	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1242	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1248	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1254	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1260	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1262	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
PCB-1268	ND	370	ug/Kg	10	09/21/22	SC	SW8082A	
QA/QC Surrogates								
% DCBP	46		%	10	09/21/22	SC	30 - 150 %	
% DCBP (Confirmation)	45		%	10	09/21/22	SC	30 - 150 %	
% TCMX	71		%	10	09/21/22	SC	30 - 150 %	
% TCMX (Confirmation)	61		%	10	09/21/22	SC	30 - 150 %	
Pesticides								
4,4' -DDD	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
4,4' -DDE	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
4,4' -DDT	2.1	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
a-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Alachlor	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Aldrin	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
b-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Chlordane	ND	37	ug/Kg	2	09/21/22	AW	SW8081B	
d-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Dieldrin	5.0	3.7	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan I	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan II	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Endosulfan sulfate	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin aldehyde	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Endrin ketone	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
g-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B	
Heptachlor	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Heptachlor epoxide	ND	7.4	ug/Kg	2	09/21/22	AW	SW8081B	
Methoxychlor	ND	37	ug/Kg	2	09/21/22	AW	SW8081B	
Toxaphene	ND	150	ug/Kg	2	09/21/22	AW	SW8081B	
QA/QC Surrogates								
% DCBP	32		%	2	09/21/22	AW	30 - 150 %	
% DCBP (Confirmation)	53		%	2	09/21/22	AW	30 - 150 %	
% TCMX	55		%	2	09/21/22	AW	30 - 150 %	
% TCMX (Confirmation)	58		%	2	09/21/22	AW	30 - 150 %	
Semivolatiles								
1,2,4,5-Tetrachlorobenzene	ND	100	ug/Kg	1	09/21/22	WB	SW8270D	
1,2,4-Trichlorobenzene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D	

Project ID: VERNON PS EXIT 67
Client ID: B-3 (0-2)

Phoenix I.D.: CM35516

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,2-Dichlorobenzene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
1,2-Diphenylhydrazine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
1,3-Dichlorobenzene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
1,4-Dichlorobenzene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2,2'-Oxybis(1-Chloropropane)	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2,4,5-Trichlorophenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2,4,6-Trichlorophenol	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dichlorophenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dimethylphenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrophenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,6-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2-Chloronaphthalene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2-Chlorophenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylnaphthalene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylphenol (o-cresol)	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitrophenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
3&4-Methylphenol (m&p-cresol)	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
3,3'-Dichlorobenzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
3-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4,6-Dinitro-2-methylphenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Bromophenyl phenyl ether	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloro-3-methylphenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloroaniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
4-Chlorophenyl phenyl ether	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitrophenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthylene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Acetophenone	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Aniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Anthracene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benz(a)anthracene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(a)pyrene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(b)fluoranthene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(ghi)perylene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(k)fluoranthene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Benzoic acid	ND	730	ug/Kg	1	09/21/22	WB	SW8270D
Benzyl butyl phthalate	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethoxy)methane	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethyl)ether	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-ethylhexyl)phthalate	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
Carbazole	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Chrysene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Dibenz(a,h)anthracene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Dibenzofuran	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Diethyl phthalate	ND	250	ug/Kg	1	09/21/22	WB	SW8270D

Project ID: VERNON PS EXIT 67
Client ID: B-3 (0-2)

Phoenix I.D.: CM35516

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Dimethylphthalate	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-butylphthalate	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-octylphthalate	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Fluoranthene	650	250	ug/Kg	1	09/21/22	WB	SW8270D
Fluorene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobenzene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobutadiene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorocyclopentadiene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Hexachloroethane	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Indeno(1,2,3-cd)pyrene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Isophorone	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Naphthalene	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Nitrobenzene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodimethylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodi-n-propylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodiphenylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Pentachloronitrobenzene	ND	140	ug/Kg	1	09/21/22	WB	SW8270D
Pentachlorophenol	ND	360	ug/Kg	1	09/21/22	WB	SW8270D
Phenanthrene	680	250	ug/Kg	1	09/21/22	WB	SW8270D
Phenol	ND	250	ug/Kg	1	09/21/22	WB	SW8270D
Pyrene	560	250	ug/Kg	1	09/21/22	WB	SW8270D
Pyridine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
QA/QC Surrogates							
% 2,4,6-Tribromophenol	90		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorobiphenyl	50		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorophenol	41		%	1	09/21/22	WB	30 - 130 %
% Nitrobenzene-d5	44		%	1	09/21/22	WB	30 - 130 %
% Phenol-d5	53		%	1	09/21/22	WB	30 - 130 %
% Terphenyl-d14	79		%	1	09/21/22	WB	30 - 130 %

3 = This parameter exceeds laboratory specified limits.

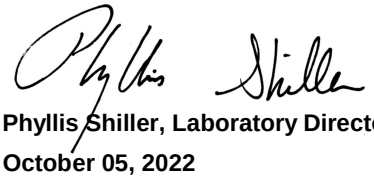
RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

Per 1.4.6 of EPA method 8270D, 1,2-Diphenylhydrazine is unstable and readily converts to Azobenzene. Azobenzene is used for the calibration of 1,2-Diphenylhydrazine.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.



Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/19/22	14:30
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35517

Project ID: VERNON PS EXIT 67
Client ID: B-4 (0-2)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Silver	< 0.35	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Arsenic	1.26	0.71	mg/Kg	1	09/21/22	TH	SW6010D
Barium	44.2	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Beryllium	0.37	0.28	mg/Kg	1	09/21/22	TH	SW6010D
Cadmium	1.07	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Chromium	14.7	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Copper	12.1	0.7	mg/kg	1	09/21/22	TH	SW6010D
Mercury	< 0.03	0.03	mg/Kg	2	09/26/22	IE	SW7471B
Nickel	8.60	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Lead	37.1	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Antimony	< 3.5	3.5	mg/Kg	1	09/21/22	TH	SW6010D
Selenium	< 1.4	1.4	mg/Kg	1	09/21/22	TH	SW6010D
Thallium	< 3.2	3.2	mg/Kg	1	09/21/22	TH	SW6010D
Vanadium	28.0	0.35	mg/Kg	1	09/21/22	TH	SW6010D
Zinc	25.5	0.7	mg/Kg	1	09/21/22	TH	SW6010D
Percent Solid	87		%		09/19/22	Q	SW846-%Solid
Soil Extraction for PCB	Completed				09/20/22	B/MO	SW3545A
Soil Extraction for Pesticide	Completed				09/20/22	B/MO	SW3545A
Mercury Digestion	Completed				09/26/22	KL/AB	SW7471B
Extraction of ETPH	Completed				09/20/22	B/U	SW3546
Soil Extraction for SVOA	Completed				09/20/22	B/C	SW3546
Total Metals Digest	Completed				09/19/22	M/AG	SW3050B

TPH by GC (Extractable Products)

Ext. Petroleum H.C. (C9-C36)	ND	57	mg/Kg	1	09/21/22	JRB	CTETPH 8015D
Identification	ND		mg/Kg	1	09/21/22	JRB	CTETPH 8015D

QA/QC Surrogates

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
% COD (surr)	69		%	1	09/21/22	JRB	50 - 150 %
% Terphenyl (surr)	70		%	1	09/21/22	JRB	50 - 150 %
Polychlorinated Biphenyls							
PCB-1016	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1221	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1232	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1242	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1248	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1254	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1260	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1262	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
PCB-1268	ND	380	ug/Kg	10	09/21/22	SC	SW8082A
QA/QC Surrogates							
% DCBP	74		%	10	09/21/22	SC	30 - 150 %
% DCBP (Confirmation)	82		%	10	09/21/22	SC	30 - 150 %
% TCMX	88		%	10	09/21/22	SC	30 - 150 %
% TCMX (Confirmation)	74		%	10	09/21/22	SC	30 - 150 %
Pesticides							
4,4' -DDD	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
4,4' -DDE	ND	3.0	ug/Kg	2	09/21/22	AW	SW8081B
4,4' -DDT	2.1	1.5	ug/Kg	2	09/21/22	AW	SW8081B
a-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
Alachlor	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Aldrin	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
b-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
Chlordane	ND	38	ug/Kg	2	09/21/22	AW	SW8081B
d-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
Dieldrin	ND	3.8	ug/Kg	2	09/21/22	AW	SW8081B
Endosulfan I	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Endosulfan II	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Endosulfan sulfate	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Endrin	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Endrin aldehyde	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Endrin ketone	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
g-BHC	ND	1.5	ug/Kg	2	09/21/22	AW	SW8081B
Heptachlor	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Heptachlor epoxide	ND	7.6	ug/Kg	2	09/21/22	AW	SW8081B
Methoxychlor	ND	38	ug/Kg	2	09/21/22	AW	SW8081B
Toxaphene	ND	150	ug/Kg	2	09/21/22	AW	SW8081B
QA/QC Surrogates							
% DCBP	55		%	2	09/21/22	AW	30 - 150 %
% DCBP (Confirmation)	87		%	2	09/21/22	AW	30 - 150 %
% TCMX	60		%	2	09/21/22	AW	30 - 150 %
% TCMX (Confirmation)	65		%	2	09/21/22	AW	30 - 150 %
Semivolatiles							
1,2,4,5-Tetrachlorobenzene	ND	100	ug/Kg	1	09/21/22	WB	SW8270D
1,2,4-Trichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D

Project ID: VERNON PS EXIT 67
Client ID: B-4 (0-2)

Phoenix I.D.: CM35517

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,2-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
1,2-Diphenylhydrazine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
1,3-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
1,4-Dichlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,2'-Oxybis(1-Chloropropane)	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4,5-Trichlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4,6-Trichlorophenol	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dichlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dimethylphenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrophenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,6-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2-Chloronaphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Chlorophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylnaphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylphenol (o-cresol)	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitrophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
3&4-Methylphenol (m&p-cresol)	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
3,3'-Dichlorobenzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
3-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4,6-Dinitro-2-methylphenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Bromophenyl phenyl ether	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloro-3-methylphenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloroaniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
4-Chlorophenyl phenyl ether	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitrophenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthylene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Acetophenone	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Aniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benz(a)anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(a)pyrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(b)fluoranthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(ghi)perylene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(k)fluoranthene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Benzoic acid	ND	770	ug/Kg	1	09/21/22	WB	SW8270D
Benzyl butyl phthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethoxy)methane	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethyl)ether	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-ethylhexyl)phthalate	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Carbazole	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Chrysene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Dibenz(a,h)anthracene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Dibenzofuran	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Diethyl phthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D

Project ID: VERNON PS EXIT 67
Client ID: B-4 (0-2)

Phoenix I.D.: CM35517

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Dimethylphthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-butylphthalate	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-octylphthalate	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Fluoranthene	380	270	ug/Kg	1	09/21/22	WB	SW8270D
Fluorene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobenzene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobutadiene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorocyclopentadiene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Hexachloroethane	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Indeno(1,2,3-cd)pyrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Isophorone	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Naphthalene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Nitrobenzene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodimethylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodi-n-propylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodiphenylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Pentachloronitrobenzene	ND	140	ug/Kg	1	09/21/22	WB	SW8270D
Pentachlorophenol	ND	380	ug/Kg	1	09/21/22	WB	SW8270D
Phenanthrene	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Phenol	ND	270	ug/Kg	1	09/21/22	WB	SW8270D
Pyrene	350	270	ug/Kg	1	09/21/22	WB	SW8270D
Pyridine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
QA/QC Surrogates							
% 2,4,6-Tribromophenol	93		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorobiphenyl	55		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorophenol	56		%	1	09/21/22	WB	30 - 130 %
% Nitrobenzene-d5	60		%	1	09/21/22	WB	30 - 130 %
% Phenol-d5	65		%	1	09/21/22	WB	30 - 130 %
% Terphenyl-d14	85		%	1	09/21/22	WB	30 - 130 %

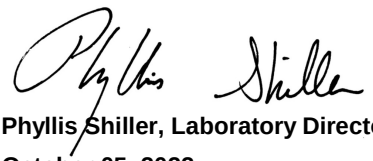
RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

Per 1.4.6 of EPA method 8270D, 1,2-Diphenylhydrazine is unstable and readily converts to Azobenzene. Azobenzene is used for the calibration of 1,2-Diphenylhydrazine.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.



Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/19/22	12:20
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35518

Project ID: VERNON PS EXIT 67
Client ID: B-1 (4-6)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Silver	< 0.36	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Arsenic	1.23	0.71	mg/Kg	1	09/21/22	TH	SW6010D
Barium	17.6	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Beryllium	< 0.28	0.28	mg/Kg	1	09/21/22	TH	SW6010D
Cadmium	1.10	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Chromium	12.7	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Copper	12.8	0.7	mg/kg	1	09/21/22	TH	SW6010D
Mercury	< 0.03	0.03	mg/Kg	2	09/26/22	IE	SW7471B
Nickel	9.08	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Lead	4.52	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Antimony	< 3.6	3.6	mg/Kg	1	09/21/22	TH	SW6010D
Selenium	< 1.4	1.4	mg/Kg	1	09/21/22	TH	SW6010D
Thallium	< 3.2	3.2	mg/Kg	1	09/21/22	TH	SW6010D
Vanadium	35.5	0.36	mg/Kg	1	09/21/22	TH	SW6010D
Zinc	16.3	0.7	mg/Kg	1	09/21/22	TH	SW6010D
Percent Solid	89		%		09/19/22	Q	SW846-%Solid
Soil Extraction for PCB	Completed				09/20/22	B/MO	SW3545A
Field Extraction	Completed				09/19/22		SW5035A
Mercury Digestion	Completed				09/26/22	KL/AB	SW7471B
Extraction of ETPH	Completed				09/20/22	B/U	SW3546
Soil Extraction for SVOA	Completed				09/20/22	B/C	SW3546
Total Metals Digest	Completed				09/19/22	M/AG	SW3050B
TPH by GC (Extractable Products)							
Ext. Petroleum H.C. (C9-C36)	ND	55	mg/Kg	1	09/22/22	JRB	CTETPH 8015D
Identification	ND		mg/Kg	1	09/22/22	JRB	CTETPH 8015D

QA/QC Surrogates

Ver 2

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
% COD (surr)	70		%	1	09/22/22	JRB	50 - 150 %
% Terphenyl (surr)	68		%	1	09/22/22	JRB	50 - 150 %
Polychlorinated Biphenyls							
PCB-1016	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1221	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1232	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1242	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1248	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1254	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1260	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1262	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
PCB-1268	ND	370	ug/Kg	10	09/22/22	SC	SW8082A
QA/QC Surrogates							
% DCBP	86		%	10	09/22/22	SC	30 - 150 %
% DCBP (Confirmation)	97		%	10	09/22/22	SC	30 - 150 %
% TCMX	77		%	10	09/22/22	SC	30 - 150 %
% TCMX (Confirmation)	69		%	10	09/22/22	SC	30 - 150 %
Volatiles							
1,1,1,2-Tetrachloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,1-Trichloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,2,2-Tetrachloroethane	ND	3.2	ug/Kg	1	09/20/22	JLI	SW8260C
1,1,2-Trichloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloroethene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,1-Dichloropropene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,3-Trichlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,3-Trichloropropane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,4-Trichlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2,4-Trimethylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dibromo-3-chloropropane	ND	5.0	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dibromoethane	ND	0.53	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,2-Dichloropropane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,3,5-Trimethylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,3-Dichlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,3-Dichloropropane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
1,4-Dichlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
2,2-Dichloropropane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
2-Chlorotoluene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
2-Hexanone	ND	27	ug/Kg	1	09/20/22	JLI	SW8260C
2-Isopropyltoluene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
4-Chlorotoluene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
4-Methyl-2-pentanone	ND	27	ug/Kg	1	09/20/22	JLI	SW8260C
Acetone	ND	270	ug/Kg	1	09/20/22	JLI	SW8260C
Acrylonitrile	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Benzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Bromobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C

Project ID: VERNON PS EXIT 67
Client ID: B-1 (4-6)

Phoenix I.D.: CM35518

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Bromochloromethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Bromodichloromethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Bromoform	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Bromomethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Carbon Disulfide	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Carbon tetrachloride	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Chlorobenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Chloroethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Chloroform	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Chloromethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
cis-1,2-Dichloroethene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
cis-1,3-Dichloropropene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Dibromochloromethane	ND	3.2	ug/Kg	1	09/20/22	JLI	SW8260C
Dibromomethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Dichlorodifluoromethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Ethylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Hexachlorobutadiene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Isopropylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
m&p-Xylene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Methyl Ethyl Ketone	ND	32	ug/Kg	1	09/20/22	JLI	SW8260C
Methyl t-butyl ether (MTBE)	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Methylene chloride	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Naphthalene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
n-Butylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
n-Propylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
o-Xylene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
p-Isopropyltoluene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
sec-Butylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Styrene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
tert-Butylbenzene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Tetrachloroethene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Tetrahydrofuran (THF)	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Toluene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Total Xylenes	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,2-Dichloroethene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,3-Dichloropropene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
trans-1,4-dichloro-2-butene	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Trichloroethene	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Trichlorofluoromethane	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
Trichlorotrifluoroethane	ND	11	ug/Kg	1	09/20/22	JLI	SW8260C
Vinyl chloride	ND	5.3	ug/Kg	1	09/20/22	JLI	SW8260C
QA/QC Surrogates							
% 1,2-dichlorobenzene-d4	96		%	1	09/20/22	JLI	70 - 130 %
% Bromofluorobenzene	103		%	1	09/20/22	JLI	70 - 130 %
% Dibromofluoromethane	98		%	1	09/20/22	JLI	70 - 130 %
% Toluene-d8	94		%	1	09/20/22	JLI	70 - 130 %
Semivolatiles							
1,2,4,5-Tetrachlorobenzene	ND	100	ug/Kg	1	09/21/22	WB	SW8270D
1,2,4-Trichlorobenzene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D

Ver 2

Project ID: VERNON PS EXIT 67
Client ID: B-1 (4-6)

Phoenix I.D.: CM35518

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
1,2-Dichlorobenzene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
1,2-Diphenylhydrazine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
1,3-Dichlorobenzene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
1,4-Dichlorobenzene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2,2'-Oxybis(1-Chloropropane)	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2,4,5-Trichlorophenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2,4,6-Trichlorophenol	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dichlorophenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dimethylphenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrophenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2,4-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2,6-Dinitrotoluene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
2-Chloronaphthalene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2-Chlorophenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylnaphthalene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2-Methylphenol (o-cresol)	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
2-Nitrophenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
3&4-Methylphenol (m&p-cresol)	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
3,3'-Dichlorobenzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
3-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4,6-Dinitro-2-methylphenol	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Bromophenyl phenyl ether	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloro-3-methylphenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
4-Chloroaniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
4-Chlorophenyl phenyl ether	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitroaniline	ND	300	ug/Kg	1	09/21/22	WB	SW8270D
4-Nitrophenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Acenaphthylene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Acetophenone	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Aniline	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Anthracene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benz(a)anthracene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benzidine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(a)pyrene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(b)fluoranthene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(ghi)perylene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benzo(k)fluoranthene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Benzoic acid	ND	750	ug/Kg	1	09/21/22	WB	SW8270D
Benzyl butyl phthalate	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethoxy)methane	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-chloroethyl)ether	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
Bis(2-ethylhexyl)phthalate	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
Carbazole	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Chrysene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Dibenz(a,h)anthracene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Dibenzofuran	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Diethyl phthalate	ND	260	ug/Kg	1	09/21/22	WB	SW8270D

Project ID: VERNON PS EXIT 67
Client ID: B-1 (4-6)

Phoenix I.D.: CM35518

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Dimethylphthalate	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-butylphthalate	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
Di-n-octylphthalate	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Fluoranthene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Fluorene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobenzene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorobutadiene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Hexachlorocyclopentadiene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Hexachloroethane	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Indeno(1,2,3-cd)pyrene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Isophorone	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Naphthalene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Nitrobenzene	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodimethylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodi-n-propylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
N-Nitrosodiphenylamine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
Pentachloronitrobenzene	ND	140	ug/Kg	1	09/21/22	WB	SW8270D
Pentachlorophenol	ND	370	ug/Kg	1	09/21/22	WB	SW8270D
Phenanthrene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Phenol	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Pyrene	ND	260	ug/Kg	1	09/21/22	WB	SW8270D
Pyridine	ND	200	ug/Kg	1	09/21/22	WB	SW8270D
QA/QC Surrogates							
% 2,4,6-Tribromophenol	78		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorobiphenyl	36		%	1	09/21/22	WB	30 - 130 %
% 2-Fluorophenol	44		%	1	09/21/22	WB	30 - 130 %
% Nitrobenzene-d5	45		%	1	09/21/22	WB	30 - 130 %
% Phenol-d5	50		%	1	09/21/22	WB	30 - 130 %
% Terphenyl-d14	68		%	1	09/21/22	WB	30 - 130 %

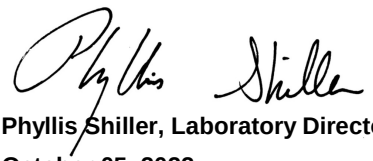
RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

Per 1.4.6 of EPA method 8270D, 1,2-Diphenylhydrazine is unstable and readily converts to Azobenzene. Azobenzene is used for the calibration of 1,2-Diphenylhydrazine.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.



Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

October 05, 2022

FOR: Attn: Harley Langford
Tighe & Bond
213 Court St, Suite 1100
Middletown, CT 06457

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		09/19/22	8:55
Location Code:	TIGHE-DAS	Received by:	SW	09/19/22	16:10
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	31-0037-017				

Laboratory Data

SDG ID: GCM35514
Phoenix ID: CM35520

Project ID: VERNON PS EXIT 67
Client ID: B-2 (6-8)

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Percent Solid	91		%		09/29/22	Q	SW846-%Solid
Soil Extraction for Pesticide	Completed				09/30/22	E/Y	SW3545A
SPLP Extraction for Organics	Completed				09/30/22	AB	SW1312
SPLP Pesticides Ext.	Completed				10/03/22	P	SW3510C
Pesticides							
4,4' -DDD	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
4,4' -DDE	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
4,4' -DDT	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
a-BHC	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
Alachlor	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Aldrin	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
b-BHC	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
Chlordane	ND	36	ug/Kg	2	10/03/22	AW	SW8081B
d-BHC	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
Dieldrin	ND	3.6	ug/Kg	2	10/03/22	AW	SW8081B
Endosulfan I	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Endosulfan II	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Endosulfan sulfate	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Endrin	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Endrin aldehyde	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Endrin ketone	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
g-BHC	ND	1.5	ug/Kg	2	10/03/22	AW	SW8081B
Heptachlor	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Heptachlor epoxide	ND	7.3	ug/Kg	2	10/03/22	AW	SW8081B
Methoxychlor	ND	36	ug/Kg	2	10/03/22	AW	SW8081B
Toxaphene	ND	150	ug/Kg	2	10/03/22	AW	SW8081B

Project ID: VERNON PS EXIT 67
Client ID: B-2 (6-8)

Phoenix I.D.: CM35520

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
QA/QC Surrogates								
% DCBP	65		%	2	10/03/22	AW	30 - 150 %	
% DCBP (Confirmation)	52		%	2	10/03/22	AW	30 - 150 %	
% TCMX	68		%	2	10/03/22	AW	30 - 150 %	
% TCMX (Confirmation)	72		%	2	10/03/22	AW	30 - 150 %	
SPLP Pesticides								
4,4' -DDD	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
4,4' -DDE	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
4,4' -DDT	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
a-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Alachlor	ND	0.010	ug/L	1	10/04/22	AW	SW8081B	
Aldrin	ND	0.003	ug/L	1	10/04/22	AW	SW8081B	
b-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Chlordane	ND	0.050	ug/L	1	10/04/22	AW	SW8081B	
d-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Dieldrin	ND	0.002	ug/L	1	10/04/22	AW	SW8081B	
Endosulfan I	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Endosulfan II	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Endosulfan sulfate	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Endrin	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Endrin aldehyde	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Endrin Ketone	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
g-BHC	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Heptachlor	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Heptachlor epoxide	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Methoxychlor	ND	0.005	ug/L	1	10/04/22	AW	SW8081B	
Toxaphene	ND	0.20	ug/L	1	10/04/22	AW	SW8081B	
QA/QC Surrogates								
%DCBP (Surrogate Rec)	32		%	1	10/04/22	AW	30 - 150 %	
%DCBP (Surrogate Rec) (Confirmation)	26		%	1	10/04/22	AW	30 - 150 %	3
%TCMX (Surrogate Rec)	73		%	1	10/04/22	AW	30 - 150 %	
%TCMX (Surrogate Rec) (Confirmation)	59		%	1	10/04/22	AW	30 - 150 %	

3 = This parameter exceeds laboratory specified limits.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level
QA/QC Surrogates: Surrogates are compounds (preceeded with a %) added by the lab to determine analysis efficiency. Surrogate results(%) listed in the report are not "detected" compounds.

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
October 05, 2022
Reviewed and Released by: Ethan Lee, Project Manager

Ver 2

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

October 05, 2022

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 643846 (mg/kg), QC Sample No: CM35395 2X (CM35515, CM35516, CM35517, CM35518)														
Mercury - Soil	BRL	0.03	0.37	0.33	11.4	103	114	10.1	116	131	12.1	70 - 130	30	m
Comment:														
Additional Mercury criteria: LCS acceptance range for waters is 80-120% and for soils is 70-130%. MS acceptance range is 75-125%.														
QA/QC Batch 642789 (mg/kg), QC Sample No: CM35476 (CM35515, CM35516, CM35517, CM35518)														
ICP Metals - Soil														
Antimony	BRL	3.3	<3.3	<3.0	NC	76.4	80.1	4.7	87.3			75 - 125	35	
Arsenic	BRL	0.67	0.92	0.80	NC	96.5	96.5	0.0	91.7			75 - 125	35	
Barium	BRL	0.33	41.0	37.5	8.90	96.7	102	5.3	94.4			75 - 125	35	
Beryllium	BRL	0.27	0.35	0.30	NC	92.4	96.8	4.7	92.0			75 - 125	35	
Cadmium	BRL	0.33	0.93	0.93	NC	92.4	98.4	6.3	85.5			75 - 125	35	
Chromium	BRL	0.33	15.7	14.8	5.90	98.1	103	4.9	89.4			75 - 125	35	
Copper	BRL	0.67	20.5	21.9	6.60	92.4	95.7	3.5	93.5			75 - 125	35	
Lead	BRL	0.33	13.5	14.4	6.50	90.2	92.9	2.9	89.9			75 - 125	35	
Nickel	BRL	0.33	15.6	12.6	21.3	95.2	98.1	3.0	92.9			75 - 125	35	
Selenium	BRL	1.3	<1.3	<1.2	NC	89.6	93.7	4.5	84.7			75 - 125	35	
Silver	BRL	0.33	<0.33	<0.30	NC	88.7	89.7	1.1	89.0			75 - 125	35	
Thallium	BRL	3.0	<3.0	<2.7	NC	88.5	91.8	3.7	92.5			75 - 125	35	
Vanadium	BRL	0.33	21.6	22.6	4.50	99.5	103	3.5	89.5			75 - 125	35	
Zinc	BRL	0.67	36.9	37.0	0.30	93.5	96.9	3.6	81.5			75 - 125	35	
Comment:														
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.														

m = This parameter is outside laboratory MS/MSD specified recovery limits.

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QA/QC Report

October 05, 2022

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 642952 (mg/Kg), QC Sample No: CM35517 (CM35515, CM35516, CM35517, CM35518)											
TPH by GC (Extractable Products) - Soil											
Ext. Petroleum H.C. (C9-C36)	ND	50	77	61	23.2	68	63	7.6	60 - 120	30	
% COD (surr)	33	%	56	39	35.8	93	108	14.9	50 - 150	30	l,r,s
% Terphenyl (surr)	69	%	81	55	38.2	79	78	1.3	50 - 150	30	r
Comment:											
Additional surrogate criteria: LCS acceptance range is 60-120% MS acceptance range 50-150%. The ETPH/DRO LCS has been normalized based on the alkane calibration.											
QA/QC Batch 642927 (ug/Kg), QC Sample No: CM33802 2X (CM35518)											
Polychlorinated Biphenyls - Soil											
PCB-1016	ND	33	74	72	2.7	92	93	1.1	40 - 140	30	
PCB-1221	ND	33							40 - 140	30	
PCB-1232	ND	33							40 - 140	30	
PCB-1242	ND	33							40 - 140	30	
PCB-1248	ND	33							40 - 140	30	
PCB-1254	ND	33							40 - 140	30	
PCB-1260	ND	33	91	94	3.2	102	106	3.8	40 - 140	30	
PCB-1262	ND	33							40 - 140	30	
PCB-1268	ND	33							40 - 140	30	
% DCBP (Surrogate Rec)	89	%	88	91	3.4	100	103	3.0	30 - 150	30	
% DCBP (Surrogate Rec) (Confirm	113	%	113	111	1.8	123	125	1.6	30 - 150	30	
% TCMX (Surrogate Rec)	72	%	73	74	1.4	92	95	3.2	30 - 150	30	
% TCMX (Surrogate Rec) (Confirm	74	%	76	75	1.3	94	95	1.1	30 - 150	30	
QA/QC Batch 642926 (ug/Kg), QC Sample No: CM35595 2X (CM35515, CM35516, CM35517)											
Polychlorinated Biphenyls - Soil											
PCB-1016	ND	33	90	93	3.3	73	67	8.6	40 - 140	30	
PCB-1221	ND	33							40 - 140	30	
PCB-1232	ND	33							40 - 140	30	
PCB-1242	ND	33							40 - 140	30	
PCB-1248	ND	33							40 - 140	30	
PCB-1254	ND	33							40 - 140	30	
PCB-1260	ND	33	96	107	10.8	90	81	10.5	40 - 140	30	
PCB-1262	ND	33							40 - 140	30	
PCB-1268	ND	33							40 - 140	30	
% DCBP (Surrogate Rec)	79	%	91	98	7.4	82	74	10.3	30 - 150	30	
% DCBP (Surrogate Rec) (Confirm	100	%	116	123	5.9	103	89	14.6	30 - 150	30	
% TCMX (Surrogate Rec)	73	%	89	93	4.4	73	64	13.1	30 - 150	30	
% TCMX (Surrogate Rec) (Confirm	75	%	88	95	7.7	74	64	14.5	30 - 150	30	
QA/QC Batch 643135 (ug/Kg), QC Sample No: CM35514 2X (CM35514)											
Pesticides - Soil											
4,4' -DDD	ND	1.7	80	77	3.8	35	41	15.8	40 - 140	30	
4,4' -DDE	ND	1.7	81	78	3.8	39	47	18.6	40 - 140	30	

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
4,4' -DDT	ND	1.7	76	75	1.3	40	47	16.1	40 - 140	30	
a-BHC	ND	1.0	78	80	2.5	40	46	14.0	40 - 140	30	
Alachlor	ND	3.3	NA	NA	NC	NA	NA	NC	40 - 140	30	
Aldrin	ND	1.0	77	84	8.7	42	50	17.4	40 - 140	30	
b-BHC	ND	1.0	87	84	3.5	44	45	2.2	40 - 140	30	
Chlordane	ND	33	77	77	0.0	41	48	15.7	40 - 140	30	
d-BHC	ND	3.3	71	69	2.9	35	40	13.3	40 - 140	30	
Dieldrin	ND	1.0	82	78	5.0	39	46	16.5	40 - 140	30	
Endosulfan I	ND	3.3	82	83	1.2	36	42	15.4	40 - 140	30	
Endosulfan II	ND	3.3	78	78	0.0	37	44	17.3	40 - 140	30	
Endosulfan sulfate	ND	3.3	82	80	2.5	39	45	14.3	40 - 140	30	
Endrin	ND	3.3	87	81	7.1	40	47	16.1	40 - 140	30	
Endrin aldehyde	ND	3.3	72	72	0.0	32	36	11.8	40 - 140	30	
Endrin ketone	ND	3.3	86	82	4.8	42	48	13.3	40 - 140	30	
g-BHC	ND	1.0	87	89	2.3	44	52	16.7	40 - 140	30	
Heptachlor	ND	3.3	83	87	4.7	44	51	14.7	40 - 140	30	
Heptachlor epoxide	ND	3.3	82	85	3.6	43	50	15.1	40 - 140	30	
Methoxychlor	ND	3.3	106	83	24.3	46	54	16.0	40 - 140	30	
Toxaphene	ND	130	NA	NA	NC	NA	NA	NC	40 - 140	30	
% DCBP	91	%	94	85	10.1	42	50	17.4	30 - 150	30	
% DCBP (Confirmation)	67	%	73	70	4.2	39	44	12.0	30 - 150	30	
% TCMX	70	%	70	77	9.5	41	47	13.6	30 - 150	30	
% TCMX (Confirmation)	68	%	68	74	8.5	43	49	13.0	30 - 150	30	
QA/QC Batch 642930 (ug/Kg), QC Sample No: CM35595 2X (CM35515, CM35516, CM35517)											
Pesticides - Soil											
4,4' -DDD	ND	1.7	85	82	3.6	64	44	37.0	40 - 140	30	r
4,4' -DDE	ND	1.7	81	76	6.4	60	65	8.0	40 - 140	30	
4,4' -DDT	ND	1.7	74	68	8.5	52	57	9.2	40 - 140	30	
a-BHC	ND	1.0	78	77	1.3	57	63	10.0	40 - 140	30	
Alachlor	ND	3.3	NA	NA	NC	NA	NA	NC	40 - 140	30	
Aldrin	ND	1.0	88	80	9.5	58	64	9.8	40 - 140	30	
b-BHC	ND	1.0	76	72	5.4	55	60	8.7	40 - 140	30	
Chlordane	ND	33	79	74	6.5	57	61	6.8	40 - 140	30	
d-BHC	ND	3.3	78	72	8.0	54	57	5.4	40 - 140	30	
Dieldrin	ND	1.0	84	78	7.4	61	65	6.3	40 - 140	30	
Endosulfan I	ND	3.3	96	88	8.7	66	71	7.3	40 - 140	30	
Endosulfan II	ND	3.3	85	77	9.9	58	44	27.5	40 - 140	30	
Endosulfan sulfate	ND	3.3	80	73	9.2	60	63	4.9	40 - 140	30	
Endrin	ND	3.3	85	79	7.3	61	66	7.9	40 - 140	30	
Endrin aldehyde	ND	3.3	69	65	6.0	66	68	3.0	40 - 140	30	
Endrin ketone	ND	3.3	81	74	9.0	60	71	16.8	40 - 140	30	
g-BHC	ND	1.0	88	86	2.3	63	68	7.6	40 - 140	30	
Heptachlor	ND	3.3	87	83	4.7	61	67	9.4	40 - 140	30	
Heptachlor epoxide	ND	3.3	84	79	6.1	59	65	9.7	40 - 140	30	
Methoxychlor	ND	3.3	85	78	8.6	62	82	27.8	40 - 140	30	
Toxaphene	ND	130	NA	NA	NC	NA	NA	NC	40 - 140	30	
% DCBP	69	%	72	70	2.8	56	58	3.5	30 - 150	30	
% DCBP (Confirmation)	82	%	101	94	7.2	77	81	5.1	30 - 150	30	
% TCMX	67	%	72	74	2.7	53	58	9.0	30 - 150	30	
% TCMX (Confirmation)	72	%	76	78	2.6	59	65	9.7	30 - 150	30	

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
QA/QC Batch 644662 (ug/Kg), QC Sample No: CM43273 2X (CM35520)											
Pesticides - Soil											
4,4' -DDD	ND	1.7	84	87	3.5	89	79	11.9	40 - 140	30	
4,4' -DDE	ND	1.7	82	88	7.1	86	80	7.2	40 - 140	30	
4,4' -DDT	ND	1.7	74	89	18.4	88	79	10.8	40 - 140	30	
a-BHC	ND	1.0	70	79	12.1	80	75	6.5	40 - 140	30	
Alachlor	ND	3.3	NA	NA	NC	NA	NA	NC	40 - 140	30	
Aldrin	ND	1.0	75	80	6.5	83	79	4.9	40 - 140	30	
b-BHC	ND	1.0	69	75	8.3	74	69	7.0	40 - 140	30	
Chlordane	ND	33	77	82	6.3	81	77	5.1	40 - 140	30	
d-BHC	ND	3.3	66	70	5.9	62	59	5.0	40 - 140	30	
Dieldrin	ND	1.0	78	82	5.0	83	76	8.8	40 - 140	30	
Endosulfan I	ND	3.3	78	89	13.2	85	78	8.6	40 - 140	30	
Endosulfan II	ND	3.3	87	90	3.4	86	79	8.5	40 - 140	30	
Endosulfan sulfate	ND	3.3	85	88	3.5	85	77	9.9	40 - 140	30	
Endrin	ND	3.3	75	78	3.9	78	72	8.0	40 - 140	30	
Endrin aldehyde	ND	3.3	75	77	2.6	74	67	9.9	40 - 140	30	
Endrin ketone	ND	3.3	84	83	1.2	81	77	5.1	40 - 140	30	
g-BHC	ND	1.0	74	84	12.7	83	77	7.5	40 - 140	30	
Heptachlor	ND	3.3	74	79	6.5	82	78	5.0	40 - 140	30	
Heptachlor epoxide	ND	3.3	77	82	6.3	84	79	6.1	40 - 140	30	
Methoxychlor	ND	3.3	75	74	1.3	77	72	6.7	40 - 140	30	
Toxaphene	ND	130	NA	NA	NC	NA	NA	NC	40 - 140	30	
% DCBP	84	%	78	75	3.9	84	77	8.7	30 - 150	30	
% DCBP (Confirmation)	72	%	65	59	9.7	62	58	6.7	30 - 150	30	
% TCMX	70	%	69	78	12.2	79	75	5.2	30 - 150	30	
% TCMX (Confirmation)	70	%	68	77	12.4	79	76	3.9	30 - 150	30	
QA/QC Batch 644949 (ug/L), QC Sample No: CM46501 (CM35515, CM35520)											
Pesticides											
4,4' -DDD	ND	0.003	70	89	23.9				40 - 140	20	r
4,4' -DDE	ND	0.003	57	95	50.0				40 - 140	20	r
4,4' -DDT	ND	0.003	50	69	31.9				40 - 140	20	r
a-BHC	ND	0.002	65	78	18.2				40 - 140	20	
Alachlor	ND	0.005	NA	NA	NC				40 - 140	20	
Aldrin	ND	0.002	62	71	13.5				40 - 140	20	
b-BHC	ND	0.002	67	86	24.8				40 - 140	20	r
Chlordane	ND	0.050	67	82	20.1				40 - 140	20	
d-BHC	ND	0.005	25	29	14.8				40 - 140	20	l
Dieldrin	ND	0.002	74	90	19.5				40 - 140	20	
Endosulfan I	ND	0.005	83	95	13.5				40 - 140	20	
Endosulfan II	ND	0.005	72	90	22.2				40 - 140	20	r
Endosulfan sulfate	ND	0.005	108	74	37.4				40 - 140	20	r
Endrin	ND	0.005	77	93	18.8				40 - 140	20	
Endrin aldehyde	ND	0.005	73	92	23.0				40 - 140	20	r
Endrin ketone	ND	0.005	118	79	39.6				40 - 140	20	r
g-BHC	ND	0.002	62	82	27.8				40 - 140	20	r
Heptachlor	ND	0.005	67	77	13.9				40 - 140	20	
Heptachlor epoxide	ND	0.005	76	86	12.3				40 - 140	20	
Methoxychlor	ND	0.005	60	88	37.8				40 - 140	20	r
Toxaphene	ND	0.20	NA	NA	NC				40 - 140	20	
% DCBP	86	%	47	78	49.6				30 - 150	20	r
% DCBP (Confirmation)	131	%	47	72	42.0				30 - 150	20	r

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL		LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
% TCMX	73	%		61	76	21.9				30 - 150	20	r
% TCMX (Confirmation)	100	%		56	79	34.1				30 - 150	20	r
QA/QC Batch 642961 (ug/kg), QC Sample No: CM34481 (CM35515, CM35516, CM35517, CM35518)												
Semivolatiles - Soil												
1,2,4,5-Tetrachlorobenzene	ND	230		61	59	3.3	72	63	13.3	40 - 140	30	
1,2,4-Trichlorobenzene	ND	230		58	58	0.0	57	48	17.1	40 - 140	30	
1,2-Dichlorobenzene	ND	180		58	58	0.0	39	34	13.7	40 - 140	30	m
1,2-Diphenylhydrazine	ND	230		99	77	25.0	89	81	9.4	40 - 140	30	
1,3-Dichlorobenzene	ND	230		59	59	0.0	35	30	15.4	40 - 140	30	m
1,4-Dichlorobenzene	ND	230		58	58	0.0	36	31	14.9	40 - 140	30	m
2,2'-Oxybis(1-Chloropropane)	ND	230		84	84	0.0	70	60	15.4	40 - 140	30	
2,4,5-Trichlorophenol	ND	230		89	66	29.7	96	93	3.2	40 - 140	30	
2,4,6-Trichlorophenol	ND	130		88	66	28.6	94	88	6.6	30 - 130	30	
2,4-Dichlorophenol	ND	130		75	65	14.3	84	75	11.3	30 - 130	30	
2,4-Dimethylphenol	ND	230		75	66	12.8	81	70	14.6	30 - 130	30	
2,4-Dinitrophenol	ND	230		60	43	33.0	50	49	2.0	30 - 130	30	r
2,4-Dinitrotoluene	ND	130		76	76	0.0	91	83	9.2	30 - 130	30	
2,6-Dinitrotoluene	ND	130		96	72	28.6	89	79	11.9	40 - 140	30	
2-Chloronaphthalene	ND	230		76	66	14.1	89	77	14.5	40 - 140	30	
2-Chlorophenol	ND	230		55	66	18.2	64	54	16.9	30 - 130	30	
2-Methylnaphthalene	ND	230		64	63	1.6	77	65	16.9	40 - 140	30	
2-Methylphenol (o-cresol)	ND	230		66	68	3.0	78	63	21.3	40 - 140	30	
2-Nitroaniline	ND	330		93	126	30.1	128	123	4.0	40 - 140	30	
2-Nitrophenol	ND	230		66	74	11.4	80	67	17.7	40 - 140	30	
3&4-Methylphenol (m&p-cresol)	ND	230		74	70	5.6	87	72	18.9	30 - 130	30	
3,3'-Dichlorobenzidine	ND	130		79	79	0.0	89	84	5.8	40 - 140	30	
3-Nitroaniline	ND	330		68	64	6.1	89	87	2.3	40 - 140	30	
4,6-Dinitro-2-methylphenol	ND	230		82	62	27.8	73	66	10.1	30 - 130	30	
4-Bromophenyl phenyl ether	ND	230		70	70	0.0	85	79	7.3	40 - 140	30	
4-Chloro-3-methylphenol	ND	230		92	71	25.8	97	93	4.2	30 - 130	30	
4-Chloroaniline	ND	230		38	38	0.0	69	80	14.8	40 - 140	30	l
4-Chlorophenyl phenyl ether	ND	230		85	65	26.7	78	68	13.7	40 - 140	30	
4-Nitroaniline	ND	230		118	89	28.0	104	95	9.0	40 - 140	30	
4-Nitrophenol	ND	230		91	91	0.0	106	91	15.2	30 - 130	30	
Acenaphthene	ND	230		79	64	21.0	75	62	19.0	30 - 130	30	
Acenaphthylene	ND	130		76	64	17.1	74	62	17.6	40 - 140	30	
Acetophenone	ND	230		56	68	19.4	67	56	17.9	40 - 140	30	
Aniline	ND	330		35	30	15.4	26	32	20.7	40 - 140	30	l,m
Anthracene	ND	230		69	69	0.0	84	78	7.4	40 - 140	30	
Benz(a)anthracene	ND	230		68	68	0.0	85	78	8.6	40 - 140	30	
Benzidine	ND	330		<10	<10	NC	<10	11	NC	40 - 140	30	l,m
Benzo(a)pyrene	ND	130		73	73	0.0	90	83	8.1	40 - 140	30	
Benzo(b)fluoranthene	ND	160		67	67	0.0	87	78	10.9	40 - 140	30	
Benzo(ghi)perylene	ND	230		69	69	0.0	90	81	10.5	40 - 140	30	
Benzo(k)fluoranthene	ND	230		87	87	0.0	75	70	6.9	40 - 140	30	
Benzoic Acid	ND	670		72	72	0.0	59	65	9.7	30 - 130	30	
Benzyl butyl phthalate	ND	230		77	77	0.0	95	88	7.7	40 - 140	30	
Bis(2-chloroethoxy)methane	ND	230		64	67	4.6	75	61	20.6	40 - 140	30	
Bis(2-chloroethyl)ether	ND	130		50	66	27.6	50	45	10.5	40 - 140	30	
Bis(2-ethylhexyl)phthalate	ND	230		75	75	0.0	93	87	6.7	40 - 140	30	
Carbazole	ND	230		68	68	0.0	83	76	8.8	40 - 140	30	
Chrysene	ND	230		69	69	0.0	84	76	10.0	40 - 140	30	

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
Dibenz(a,h)anthracene	ND	130	67	67	0.0	85	77	9.9	40 - 140	30	
Dibenzofuran	ND	230	83	65	24.3	76	66	14.1	40 - 140	30	
Diethyl phthalate	ND	230	91	68	28.9	81	73	10.4	40 - 140	30	
Dimethylphthalate	ND	230	89	68	26.8	80	72	10.5	40 - 140	30	
Di-n-butylphthalate	ND	670	74	74	0.0	90	84	6.9	40 - 140	30	
Di-n-octylphthalate	ND	230	79	79	0.0	100	92	8.3	40 - 140	30	
Fluoranthene	ND	230	69	69	0.0	86	78	9.8	40 - 140	30	
Fluorene	ND	230	90	68	27.8	82	71	14.4	40 - 140	30	
Hexachlorobenzene	ND	130	70	70	0.0	84	77	8.7	40 - 140	30	
Hexachlorobutadiene	ND	230	56	56	0.0	52	42	21.3	40 - 140	30	
Hexachlorocyclopentadiene	ND	230	47	52	10.1	51	40	24.2	40 - 140	30	
Hexachloroethane	ND	130	58	58	0.0	37	31	17.6	40 - 140	30	m
Indeno(1,2,3-cd)pyrene	ND	230	73	73	0.0	93	83	11.4	40 - 140	30	
Isophorone	ND	130	63	62	1.6	71	60	16.8	40 - 140	30	
Naphthalene	ND	230	61	61	0.0	63	53	17.2	40 - 140	30	
Nitrobenzene	ND	130	69	69	0.0	67	57	16.1	40 - 140	30	
N-Nitrosodimethylamine	ND	230	59	59	0.0	27	23	16.0	40 - 140	30	m
N-Nitrosodi-n-propylamine	ND	130	64	73	13.1	74	63	16.1	40 - 140	30	
N-Nitrosodiphenylamine	ND	130	84	63	28.6	77	70	9.5	40 - 140	30	
Pentachloronitrobenzene	ND	230	69	69	0.0	84	77	8.7	40 - 140	30	
Pentachlorophenol	ND	230	62	62	0.0	56	54	3.6	30 - 130	30	
Phenanthrene	ND	130	67	67	0.0	81	76	6.4	40 - 140	30	
Phenol	ND	230	70	72	2.8	81	66	20.4	30 - 130	30	
Pyrene	ND	230	69	69	0.0	86	76	12.3	30 - 130	30	
Pyridine	ND	230	47	47	0.0	19	14	30.3	40 - 140	30	m
% 2,4,6-Tribromophenol	99	%	86	86	0.0	126	129	2.4	30 - 130	30	
% 2-Fluorobiphenyl	67	%	69	61	12.3	81	69	16.0	30 - 130	30	
% 2-Fluorophenol	67	%	48	63	27.0	54	47	13.9	30 - 130	30	
% Nitrobenzene-d5	69	%	66	66	0.0	64	55	15.1	30 - 130	30	
% Phenol-d5	73	%	68	68	0.0	76	62	20.3	30 - 130	30	
% Terphenyl-d14	80	%	67	67	0.0	99	99	0.0	30 - 130	30	

Comment:

Additional 8270 criteria: 20% of compounds can be outside of acceptance criteria as long as recovery is at least 10%. (Acid surrogates acceptance range for aqueous samples: 15-110%, for soils 30-130%)

QA/QC Batch 643101 (ug/kg), QC Sample No: CM35236 (CM35515, CM35518)

Volatiles - Soil (Low Level)

1,1,1,2-Tetrachloroethane	ND	5.0	104	106	1.9	97	96	1.0	70 - 130	30	
1,1,1-Trichloroethane	ND	5.0	98	102	4.0	92	93	1.1	70 - 130	30	
1,1,2,2-Tetrachloroethane	ND	3.0	98	99	1.0	89	90	1.1	70 - 130	30	
1,1,2-Trichloroethane	ND	5.0	96	100	4.1	93	90	3.3	70 - 130	30	
1,1-Dichloroethane	ND	5.0	99	101	2.0	85	83	2.4	70 - 130	30	
1,1-Dichloroethene	ND	5.0	91	94	3.2	84	85	1.2	70 - 130	30	
1,1-Dichloropropene	ND	5.0	100	96	4.1	92	92	0.0	70 - 130	30	
1,2,3-Trichlorobenzene	ND	5.0	100	97	3.0	66	66	0.0	70 - 130	30	m
1,2,3-Trichloropropane	ND	5.0	101	96	5.1	86	93	7.8	70 - 130	30	
1,2,4-Trichlorobenzene	ND	5.0	98	95	3.1	66	70	5.9	70 - 130	30	m
1,2,4-Trimethylbenzene	ND	1.0	100	94	6.2	86	85	1.2	70 - 130	30	
1,2-Dibromo-3-chloropropane	ND	5.0	108	107	0.9	90	90	0.0	70 - 130	30	
1,2-Dibromoethane	ND	5.0	98	99	1.0	91	94	3.2	70 - 130	30	
1,2-Dichlorobenzene	ND	5.0	98	95	3.1	80	80	0.0	70 - 130	30	
1,2-Dichloroethane	ND	5.0	100	101	1.0	93	93	0.0	70 - 130	30	
1,2-Dichloropropane	ND	5.0	98	98	0.0	91	91	0.0	70 - 130	30	

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits	
1,3,5-Trimethylbenzene	ND	1.0	102	95	7.1	88	87	1.1	70 - 130	30	
1,3-Dichlorobenzene	ND	5.0	98	93	5.2	79	79	0.0	70 - 130	30	
1,3-Dichloropropane	ND	5.0	97	99	2.0	93	93	0.0	70 - 130	30	
1,4-Dichlorobenzene	ND	5.0	96	93	3.2	79	79	0.0	70 - 130	30	
2,2-Dichloropropane	ND	5.0	104	107	2.8	95	94	1.1	70 - 130	30	
2-Chlorotoluene	ND	5.0	103	99	4.0	88	89	1.1	70 - 130	30	
2-Hexanone	ND	25	90	93	3.3	73	73	0.0	70 - 130	30	
2-Isopropyltoluene	ND	5.0	100	96	4.1	87	84	3.5	70 - 130	30	
4-Chlorotoluene	ND	5.0	100	93	7.3	84	84	0.0	70 - 130	30	
4-Methyl-2-pentanone	ND	25	96	102	6.1	86	84	2.4	70 - 130	30	
Acetone	ND	10	73	80	9.2	62	66	6.3	70 - 130	30	m
Acrylonitrile	ND	5.0	92	102	10.3	76	79	3.9	70 - 130	30	
Benzene	ND	1.0	98	97	1.0	93	92	1.1	70 - 130	30	
Bromobenzene	ND	5.0	103	100	3.0	90	90	0.0	70 - 130	30	
Bromochloromethane	ND	5.0	99	102	3.0	90	90	0.0	70 - 130	30	
Bromodichloromethane	ND	5.0	101	103	2.0	94	97	3.1	70 - 130	30	
Bromoform	ND	5.0	104	108	3.8	93	92	1.1	70 - 130	30	
Bromomethane	ND	5.0	83	86	3.6	74	72	2.7	70 - 130	30	
Carbon Disulfide	ND	5.0	88	89	1.1	76	77	1.3	70 - 130	30	
Carbon tetrachloride	ND	5.0	102	103	1.0	93	92	1.1	70 - 130	30	
Chlorobenzene	ND	5.0	98	97	1.0	90	88	2.2	70 - 130	30	
Chloroethane	ND	5.0	91	94	3.2	84	84	0.0	70 - 130	30	
Chloroform	ND	5.0	96	101	5.1	91	91	0.0	70 - 130	30	
Chloromethane	ND	5.0	84	87	3.5	73	74	1.4	70 - 130	30	
cis-1,2-Dichloroethene	ND	5.0	96	101	5.1	90	91	1.1	70 - 130	30	
cis-1,3-Dichloropropene	ND	5.0	104	105	1.0	94	95	1.1	70 - 130	30	
Dibromochloromethane	ND	3.0	105	104	1.0	95	96	1.0	70 - 130	30	
Dibromomethane	ND	5.0	98	101	3.0	93	94	1.1	70 - 130	30	
Dichlorodifluoromethane	ND	5.0	82	81	1.2	67	68	1.5	70 - 130	30	m
Ethylbenzene	ND	1.0	99	98	1.0	92	89	3.3	70 - 130	30	
Hexachlorobutadiene	ND	5.0	101	92	9.3	66	62	6.3	70 - 130	30	m
Isopropylbenzene	ND	1.0	102	95	7.1	91	91	0.0	70 - 130	30	
m&p-Xylene	ND	2.0	98	96	2.1	92	89	3.3	70 - 130	30	
Methyl ethyl ketone	ND	5.0	84	92	9.1	74	79	6.5	70 - 130	30	
Methyl t-butyl ether (MTBE)	ND	1.0	91	98	7.4	88	88	0.0	70 - 130	30	
Methylene chloride	ND	5.0	76	80	5.1	74	76	2.7	70 - 130	30	
Naphthalene	ND	5.0	100	102	2.0	70	72	2.8	70 - 130	30	
n-Butylbenzene	ND	1.0	103	95	8.1	81	79	2.5	70 - 130	30	
n-Propylbenzene	ND	1.0	103	97	6.0	90	90	0.0	70 - 130	30	
o-Xylene	ND	2.0	99	97	2.0	91	89	2.2	70 - 130	30	
p-Isopropyltoluene	ND	1.0	102	95	7.1	87	84	3.5	70 - 130	30	
sec-Butylbenzene	ND	1.0	102	95	7.1	86	84	2.4	70 - 130	30	
Styrene	ND	5.0	101	99	2.0	89	88	1.1	70 - 130	30	
tert-Butylbenzene	ND	1.0	103	97	6.0	91	88	3.4	70 - 130	30	
Tetrachloroethene	ND	5.0	102	98	4.0	95	91	4.3	70 - 130	30	
Tetrahydrofuran (THF)	ND	5.0	91	98	7.4	84	85	1.2	70 - 130	30	
Toluene	ND	1.0	103	99	4.0	94	94	0.0	70 - 130	30	
trans-1,2-Dichloroethene	ND	5.0	94	92	2.2	84	85	1.2	70 - 130	30	
trans-1,3-Dichloropropene	ND	5.0	106	109	2.8	96	97	1.0	70 - 130	30	
trans-1,4-dichloro-2-butene	ND	5.0	112	116	3.5	97	95	2.1	70 - 130	30	
Trichloroethene	ND	5.0	101	98	3.0	90	92	2.2	70 - 130	30	
Trichlorofluoromethane	ND	5.0	95	97	2.1	87	86	1.2	70 - 130	30	
Trichlorotrifluoroethane	ND	5.0	88	88	0.0	77	77	0.0	70 - 130	30	

QA/QC Data

SDG I.D.: GCM35514

Parameter	Blank	Blk RL	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Vinyl chloride	ND	5.0	91	91	0.0	81	83	2.4	70 - 130	30
% 1,2-dichlorobenzene-d4	96	%	101	99	2.0	98	100	2.0	70 - 130	30
% Bromofluorobenzene	102	%	100	99	1.0	99	102	3.0	70 - 130	30
% Dibromofluoromethane	96	%	96	101	5.1	101	98	3.0	70 - 130	30
% Toluene-d8	95	%	101	101	0.0	101	101	0.0	70 - 130	30

Comment:

Additional 8260 criteria: 10% of LCS/LCSD compounds can be outside of acceptance criteria as long as recovery is 40-160%, 25-160% for Chloroethane-HL and Trichlorofluoromethane-HL.

l = This parameter is outside laboratory LCS/LCSD specified recovery limits.
m = This parameter is outside laboratory MS/MSD specified recovery limits.
r = This parameter is outside laboratory RPD specified recovery limits.
s = This parameter is outside laboratory Blank Surrogate specified recovery limits.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller, Laboratory Director
October 05, 2022

Wednesday, October 05, 2022

Criteria: CT: GAM, GBM, I/C, RC

State: CT

Sample Criteria Exceedances Report

GCM35514 - TIGHE-DAS

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units
CM35515	$PEST_SMR	Dieldrin	CT / RSR GA (mg/kg) / Pesticides/TPH	9.6	3.9	7	7	ug/Kg
CM35515	$PEST_SMR	4,4' -DDT	CT / RSR GA,GAA (mg/kg) / APS Organics	4.5	1.5	3	3	ug/Kg
CM35515	$PEST_SMR	Dieldrin	CT / RSR GB (mg/kg) / Pesticides/TPH	9.6	3.9	7	7	ug/Kg

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

REASONABLE CONFIDENCE PROTOCOL
LABORATORY ANALYSIS QA/QC CERTIFICATION FORM

Laboratory Name: Phoenix Environmental Labs, Inc. ***Client:*** Tighe & Bond

Project Location: VERNON PS EXIT 67 ***Project Number:***

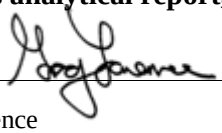
Laboratory Sample ID(s): CM35514-CM35518 ***Sampling Date(s):*** 9/16/2022, 9/19/2022

List RCP Methods Used (e.g., 8260, 8270, et cetera) 1311/1312, 6010, 7470/7471, 8081, 8082, 8260, 8270, ETPH

1	**For each analytical method referenced in this laboratory report package, were all specified QA/QC performance criteria followed, including the requirement to explain any criteria falling outside of acceptable guidelines, as specified in the CT DEP method-specific Reasonable Confidence Protocol documents?**	☑ Yes ☐ No
1A	**Were the method specified preservation and holding time requirements met?**	☑ Yes ☐ No
1B	***VPH and EPH methods only:*** **Was the VPH or EPH method conducted without significant modifications (see section 11.3 of respective RCP methods)**	☐ Yes ☐ No ☑ NA
2	**Were all samples received by the laboratory in a condition consistent with that described on the associated Chain-of-Custody document(s)?**	☑ Yes ☐ No
3	**Were samples received at an appropriate temperature (< 6 Degrees C)?**	☑ Yes ☐ No ☐ NA
4	**Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents acheived? See Sections: ETPH Narration, PEST Narration, SVOA Narration.**	☐ Yes ☑ No
5	**a) Were reporting limits specified or referenced on the chain-of-custody?** **b) Were these reporting limits met?**	☑ Yes ☐ No ☑ Yes ☐ No
6	**For each analytical method referenced in this laboratory report package, were results reported for all constituents identified in the method-specific analyte lists presented in the Reasonable Confidence Protocol documents?**	☑ Yes ☐ No
7	**Are project-specific matrix spikes and laboratory duplicates included in the data set?**	☑ Yes ☐ No

Notes: For all questions to which the response was "No" (with the exception of question #7), additional information must be provided in an attached narrative. If the answer to question #1, #1A or 1B is "No", the data package does not meet the requirements for "Reasonable Confidence". This form may not be altered and all questions must be answered.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete.

Authorized Signature:  **Position:** Assistant Lab Director

Printed Name: Greg Lawrence **Date:** Wednesday, October 05, 2022

Name of Laboratory Phoenix Environmental Labs, Inc.

This certification form is to be used for RCP methods only.

Environmental Laboratories, Inc.
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NY # 11301

RCP Certification Report

October 05, 2022

SDG I.D.: GCM35514

ETPH Narration

Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents achieved? No.

QC Batch 642952 (Samples: CM35515, CM35516, CM35517, CM35518): -----

One or more surrogates is outside of criteria. (% COD (surr))

The blank surrogate was below criteria. (% COD (surr)(CM35517))

The LCS/LCSD RPD exceeds the method criteria for one or more surrogates, therefore there may be variability in the reported result. (% COD (surr), % Terphenyl (surr))

Instrument:

AU-FID1 09/21/22-1 Jeff Bucko, Chemist 09/21/22

CM35515 (5X)

The initial calibration (ET_908AI) RSD for the compound list was less than 30% except for the following compounds: None.
As per section 7.2.3, a discrimination check standard was run (921A005_1) and contained the following outliers: None.
The continuing calibration %D for the compound list was less than 30% except for the following compounds:None.

AU-FID1 09/22/22-1 Jeff Bucko, Chemist 09/22/22

CM35518 (1X)

The initial calibration (ET_908AI) RSD for the compound list was less than 30% except for the following compounds: None.
As per section 7.2.3, a discrimination check standard was run (922A003_1) and contained the following outliers: None.
The continuing calibration %D for the compound list was less than 30% except for the following compounds:None.

AU-FID84 09/21/22-1 Jeff Bucko, Chemist 09/21/22

CM35516 (1X), CM35517 (1X)

The initial calibration (ET_908AI) RSD for the compound list was less than 30% except for the following compounds: None.
As per section 7.2.3, a discrimination check standard was run (921A003_1) and contained the following outliers: None.
The continuing calibration %D for the compound list was less than 30% except for the following compounds:
Samples: CM35516, CM35517
Preceding CC 921A019 - % COD (surr) -41%L (30%)
Succeeding CC 921A031 - None.

QC (Site Specific):

Batch 642952 (CM35517)

CM35515, CM35516, CM35517, CM35518

All LCS recoveries were within 60 - 120 with the following exceptions: None.
All LCSD recoveries were within 60 - 120 with the following exceptions: % COD (surr)(39%)
All LCS/LCSD RPDs were less than 30% with the following exceptions: % COD (surr)(35.8%), % Terphenyl (surr)(38.2%)
All MS recoveries were within 50 - 150 with the following exceptions: None.
All MSD recoveries were within 50 - 150 with the following exceptions: None.
All MS/MSD RPDs were less than 30% with the following exceptions: None.
Additional surrogate criteria: LCS acceptance range is 60-120% MS acceptance range 50-150%. The ETPH/DRO LCS has been normalized based on the alkane calibration.

Mercury Narration

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NY # 11301

Certification Report

October 05, 2022

SDG I.D.: GCM35514

Mercury Narration

Were all QA/QC performance criteria specified in the analytical method achieved? Yes.

Instrument:

MERLIN 09/26/22 17:04 Ian Enders, Chemist 09/26/22

CM35515, CM35516, CM35517, CM35518

The method preparation blank, ICB, and CCBs contain all of the acids and reagents as the samples.
The initial calibration met all criteria including a standard run at or below the reporting level.
All calibration verification standards (ICV, CCV) met criteria.
All calibration blank verification standards (ICB, CCB) met criteria.
The matrix spike sample is used to identify spectral interference for each batch of samples, if within 85-115%, no interference is observed and no further action is taken.
The following Initial Calibration Verification (ICV) compounds did not meet criteria: None.
The following Continuing Calibration Verification (CCV) compounds did not meet criteria: None.

QC (Batch Specific):

Batch 643846 (CM35395)

CM35515, CM35516, CM35517, CM35518

All LCS recoveries were within 70 - 130 with the following exceptions: None.
All LCSD recoveries were within 70 - 130 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.
Additional Mercury criteria: LCS acceptance range for waters is 80-120% and for soils is 70-130%. MS acceptance range is 75-125%.

ICP Metals Narration

Were all QA/QC performance criteria specified in the analytical method achieved? Yes.

Instrument:

ARCOS-2 09/21/22 12:02 Tina Hall, Chemist 09/21/22

CM35515, CM35516, CM35517, CM35518

The linear range is defined daily by the calibration range.
The following Initial Calibration Verification (ICV) compounds did not meet criteria: None.
The following Continuing Calibration Verification (CCV) compounds did not meet criteria: None.
The following ICP Interference Check (ICSAB) compounds did not meet criteria: None.

QC (Batch Specific):

Batch 642789 (CM35476)

CM35515, CM35516, CM35517, CM35518

All LCS recoveries were within 75 - 125 with the following exceptions: None.
All LCSD recoveries were within 75 - 125 with the following exceptions: None.
All LCS/LCSD RPDs were less than 35% with the following exceptions: None.
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.

PCB Narration

Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents achieved? Yes.

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SDG I.D.: GCM35514

PCB Narration

Instrument:

AU-ECD3 09/22/22-1 Saadia Chudary, Chemist 09/22/22

CM35518 (10X)

The initial calibration (PC907AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PC907BI) RSD for the compound list was less than 20% except for the following compounds: None.
The continuing calibration %D for the compound list was less than 15% except for the following compounds:None.

AU-ECD48 09/21/22-1 Saadia Chudary, Chemist 09/21/22

CM35515 (10X), CM35516 (10X), CM35517 (10X)

The initial calibration (PC909AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PC909BI) RSD for the compound list was less than 20% except for the following compounds: None.
The continuing calibration %D for the compound list was less than 15% except for the following compounds:
Samples: CM35515, CM35517
Preceding CC 921B033 - None.
Succeeding CC 921B046 - DCBP SURR -16%L (15%)

QC (Batch Specific):

Batch 642926 (CM35595)

CM35515, CM35516, CM35517

All LCS recoveries were within 40 - 140 with the following exceptions: None.
All LCSD recoveries were within 40 - 140 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.

Batch 642927 (CM33802)

CM35518

All LCS recoveries were within 40 - 140 with the following exceptions: None.
All LCSD recoveries were within 40 - 140 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.

PEST Narration

Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents achieved? No.

QC Batch 644949 (Samples: CM35515, CM35520): -----

One or more analytes is below the method criteria. A low bias for these analytes is possible. (d-BHC)

The LCS/LCSD RPD exceeds the method criteria for one or more analytes, but these analytes were not reported in the sample(s) so no variability is suspected. (4,4'' -DDD, 4,4'' -DDE, 4,4'' -DDT, b-BHC, Endosulfan II, Endosulfan sulfate, Endrin aldehyde, Endrin ketone, g-BHC, Methoxychlor)

The LCS/LCSD RPD exceeds the method criteria for one or more surrogates, therefore there may be variability in the reported result. (% DCBP, % DCBP (Confirmation), % TCMX, % TCMX (Confirmation))

Instrument:

AU-ECD35 10/03/22-1 Adam Werner, Chemist 10/03/22

CM35520 (2X)

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SDG I.D.: GCM35514

PEST Narration

The initial calibration (PS0901AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PS0901BI) RSD for the compound list was less than 20% except for the following compounds: None.
The Endrin and DDT breakdown does not exceed 15% except for the following compounds:None.
The Endrin and DDT breakdown does not exceed the maximum of 20% except for the following compounds:None.
The continuing calibration %D for the compound list was less than 20% except for the following compounds:
Samples: CM35520
Preceding CC O03B038 - Endosulfan II -22%L (20%)
Succeeding CC O03B051 - Endosulfan II -24%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.

AU-ECD35 10/04/22-1 Adam Werner, Chemist 10/04/22

CM35515 (1X), CM35520 (1X)

The initial calibration (PS0901AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PS0901BI) RSD for the compound list was less than 20% except for the following compounds: None.
The Endrin and DDT breakdown does not exceed 15% except for the following compounds:None.
The Endrin and DDT breakdown does not exceed the maximum of 20% except for the following compounds:None.
The continuing calibration %D for the compound list was less than 20% except for the following compounds:
Samples: CM35515, CM35520
Preceding CC O04A021 - % DCBP -26%L (20%), 4,4'-DDE -42%L (20%), Endosulfan I 30%H (20%)
Succeeding CC O04A035 - % DCBP -37%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.
Samples: CM35515, CM35520
Preceding CC O04B021 - Methoxychlor -22%L (20%)
Succeeding CC O04B035 - Methoxychlor -21%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.

AU-ECD4 09/21/22-1 Adam Werner, Chemist 09/21/22

CM35516 (2X), CM35517 (2X)

The initial calibration (PS0902AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PS0902BI) RSD for the compound list was less than 20% except for the following compounds: None.
The Endrin and DDT breakdown does not exceed 15% except for the following compounds:None.
The Endrin and DDT breakdown does not exceed the maximum of 20% except for the following compounds:None.
The continuing calibration %D for the compound list was less than 20% except for the following compounds:
Samples: CM35516, CM35517
Preceding CC 921B033 - b-BHC -25%L (20%)
Succeeding CC 921B047 - % DCBP -27%L (20%), Endosulfan II -22%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.

AU-ECD6 09/21/22-1 Adam Werner, Chemist 09/21/22

CM35515 (2X)

The initial calibration (PS0909AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PS0909BI) RSD for the compound list was less than 20% except for the following compounds: None.
The Endrin and DDT breakdown does not exceed 15% except for the following compounds:None.
The Endrin and DDT breakdown does not exceed the maximum of 20% except for the following compounds:None.
The continuing calibration %D for the compound list was less than 20% except for the following compounds:
Samples: CM35515

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SDG I.D.: GCM35514

PEST Narration

Preceding CC 921B020 - Endosulfan II -30%L (20%)
Succeeding CC 921B033 - Endosulfan II -26%L (20%), Endrin aldehyde -23%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.

AU-ECD6 09/22/22-1 Adam Werner, Chemist 09/22/22

CM35514 (2X)

The initial calibration (PS0909AI) RSD for the compound list was less than 20% except for the following compounds: None.
The initial calibration (PS0909BI) RSD for the compound list was less than 20% except for the following compounds: None.
The Endrin and DDT breakdown does not exceed 15% except for the following compounds:None.
The Endrin and DDT breakdown does not exceed the maximum of 20% except for the following compounds:None.
The continuing calibration %D for the compound list was less than 20% except for the following compounds:
Samples: CM35514
Preceding CC 922B031 - Endosulfan II -27%L (20%), Endrin aldehyde -26%L (20%)
Succeeding CC 922B042 - Endosulfan II -26%L (20%)
A low "1A" standard was run after the samples to demonstrate capability to detect any compounds outside of the CC acceptance criteria. All reported samples were ND for the affected compounds.

QC (Batch Specific):

Batch 642930 (CM35595)

CM35515, CM35516, CM35517

All LCS recoveries were within 40 - 140 with the following exceptions: None.
All LCSD recoveries were within 40 - 140 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.

Batch 644662 (CM43273)

CM35520

All LCS recoveries were within 40 - 140 with the following exceptions: None.
All LCSD recoveries were within 40 - 140 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.

Batch 644949 (CM46501)

CM35515, CM35520

All LCS recoveries were within 40 - 140 with the following exceptions: d-BHC(25%)
All LCSD recoveries were within 40 - 140 with the following exceptions: d-BHC(29%)
All LCS/LCSD RPDs were less than 20% with the following exceptions: % DCBP(49.6%), % DCBP (Confirmation)(42.0%), % TCMX(21.9%), % TCMX (Confirmation)(34.1%), 4,4' -DDD(23.9%), 4,4' -DDE(50.0%), 4,4' -DDT(31.9%), b-BHC(24.8%), Endosulfan II(22.2%), Endosulfan sulfate(37.4%), Endrin aldehyde(23.0%), Endrin ketone(39.6%), g-BHC(27.8%), Methoxychlor(37.8%)

QC (Site Specific):

Batch 643135 (CM35514)

CM35514

All LCS recoveries were within 40 - 140 with the following exceptions: None.
All LCSD recoveries were within 40 - 140 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.
All MS recoveries were within 30 - 150 with the following exceptions: None.

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SDG I.D.: GCM35514

PEST Narration

All MSD recoveries were within 30 - 150 with the following exceptions: None.
All MS/MSD RPDs were less than 30% with the following exceptions: None.

SVOA Narration

Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents achieved? No.

QC Batch 642961 (Samples: CM35515, CM35516, CM35517, CM35518): -----

One or more analytes is below the method criteria. A low bias for these analytes is possible. (4-Chloroaniline)

The LCS/LCSD RPD exceeds the method criteria for one or more analytes, but these analytes were not reported in the sample(s) so no variability is suspected. (2,4-Dinitrophenol)

The QC recoveries for one or more analytes is below the method criteria. A slight low bias is likely. (Aniline, Benzidine)

Instrument:

CHEM07 09/20/22-1 Matt Richard, Chemist 09/20/22

CM35515 (1X), CM35516 (1X), CM35517 (1X), CM35518 (1X)

For 8270 full list, the DDT breakdown and pentachlorophenol & benzidine peak tailing were evaluated in the DFTPP tune and were found to be in control.
For 8270 BN list, benzidine peak tailing was evaluated in the DFTPP tune and was found to be in control.

Initial Calibration Evaluation (CHEM07/7_SPLIT_0906):
100% of target compounds met criteria.
The following compounds had %RSDs >20%: None.
The following compounds did not meet recommended response factors: % 2,4,6-Tribromophenol 0.043 (0.05), 2-Nitrophenol 0.058 (0.1), Hexachlorobenzene 0.074 (0.1)
The following compounds did not meet a minimum response factors: % 2,4,6-Tribromophenol 0.043 (0.05)

Continuing Calibration Verification (CHEM07/0920_09-7_SPLIT_0906):
Internal standard areas were within 50 to 200% of the initial calibration with the following exceptions: None.
98% of target compounds met criteria.
The following compounds did not meet % deviation criteria: % 2,4,6-Tribromophenol 35%H (30%), Pentachlorophenol 33%L (30%)
The following compounds did not meet maximum % deviations: None.
The following compounds did not meet recommended response factors: 2-Nitrophenol 0.060 (0.1), Hexachlorobenzene 0.073 (0.1)
The following compounds did not meet minimum response factors: None.

QC (Batch Specific):

Batch 642961 (CM34481)

CM35515, CM35516, CM35517, CM35518

All LCS recoveries were within 40 - 140 with the following exceptions: 4-Chloroaniline(38%), Aniline(35%), Benzidine(<10%)
All LCSD recoveries were within 40 - 140 with the following exceptions: 4-Chloroaniline(38%), Aniline(30%), Benzidine(<10%)
All LCS/LCSD RPDs were less than 30% with the following exceptions: 2,4-Dinitrophenol(33.0%)
Additional 8270 criteria: 20% of compounds can be outside of acceptance criteria as long as recovery is at least 10%. (Acid

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SVOA Narration

surrogates acceptance range for aqueous samples: 15-110%, for soils 30-130%)

VOA Narration

Were all QA/QC performance criteria specified in the Reasonable Confidence Protocol documents achieved? Yes.

Instrument:

CHEM18 09/20/22-1 Jane Li, Chemist 09/20/22

CM35515 (1X), CM35518 (1X)

Initial Calibration Evaluation (CHEM18/VT-M091822):
96% of target compounds met criteria.
The following compounds had %RSDs >20%: Acetone 31% (20%), Methylene chloride 26% (20%), trans-1,4-dichloro-2-butene 25% (20%)
The following compounds did not meet Table 4 recommended minimum response factors: Acetone 0.097 (0.1)
The following compounds did not meet the minimum response factor of 0.05: None.

Continuing Calibration Verification (CHEM18/0920_02-VT-M091822):
Internal standard areas were within 50 to 200% of the initial calibration with the following exceptions: None.
100% of target compounds met criteria.
The following compounds did not meet % deviation criteria: None.
The following compounds did not meet maximum % deviations: None.
The following compounds did not meet Table 4 recommended minimum response factors: None.

QC (Batch Specific):

Batch 643101 (CM35236) CHEM18 9/20/2022-1

CM35515(1X), CM35518(1X)

All LCS recoveries were within 70 - 130 with the following exceptions: None.
All LCSD recoveries were within 70 - 130 with the following exceptions: None.
All LCS/LCSD RPDs were less than 30% with the following exceptions: None.
Additional 8260 criteria: 10% of LCS/LCSD compounds can be outside of acceptance criteria as long as recovery is 40-160%, 25-160% for Chloroethane-HL and Trichlorofluoromethane-HL.

Temperature Narration

The samples were received at 2.0C with cooling initiated.
(Note acceptance criteria for relevant matrices is above freezing up to 6°C)

Cooler: Yes [X] No [ ]
Coolant: IPK [ ] ICE [X] No [ ]

PHOENIX
Environmental Laboratories, Inc.

CHAIN OF CUSTODY RECORD

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Temp 2.0 °C Pg 1 of 1

Data Delivery/Contact Options:
[ ] Fax:
[ ] Phone:
[X] Email: HACunyford@tyleebond.com

Customer: Tyle & Bond Inc
Address: 213 Court Street 11th Floor
Middletown, CT 06457

Project: Vernon PS, Exit 67
Report to: Hurley Cunyford, Casey Watts-Hill (Lobby)
Invoice to: Tyle & Bond Westfield
QUOTE # DAS Pricing

Project P.O: 31-0037-017

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature: Cunyford Date: 9/19/22

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = _____(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	VOCs	ETPH	PCBs	SVOCs	Pesticides	RCP 15 Metals	Sample on hold	MS/MSD*	GL Amber 8 oz. [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container ( ) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [ ] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
35514	B-1 (0-2)	S	9/16/22	1500	X	X	X	X	X	X					3	1								
35515	B-2 (0-2)	S	9/19/22	1455	X	X	X	X	X	X					3	1								
35516	B-3 (0-2)	S	9/19/22	1425	X	X	X	X	X	X					3	1								
35517	B-4 (0-2)	S	9/19/22	1430	X	X	X	X	X	X					3	1								
35518	B-1 (4-6)	S	9/19/22	1220	X	X	X	X		X					3	1								
35519	B-1 (20-22)	S	9/19/22	1330								X			3	1								
35520	B-2 (6-8)	S	9/19/22	0855								X			3	1								
35521	B-2 (10-12)	S	9/19/22	0915								X			3	1								
35522	B-2 (35-37)	S	9/19/22	1000								X			3	1								

Relinquished by:	Accepted by:	Date:	Time:
Cunyford	Phoenix Labs Lobby	9/19/22	1610

Comments, Special Requirements or Regulations:
* Did not receive VOAs (2)

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
[ ] 1 Day*
[ ] 2 Days*
[ ] 3 Days*
[X] Standard
[ ] Other
* SURCHARGE APPLIES

RI
[ ] (Residential) Direct Exposure
[ ] (Comm/Industrial) Direct Exposure
[ ] GA Leachability
[ ] GB Leachability
[ ] GA-GW Objectives
[ ] GB-GW Objectives

CT
[X] RCP Cert
[ ] GW Protection
[ ] SW Protection
[X] GA Mobility
[X] GB Mobility
[X] Residential DEC
[X] I/C DEC
[ ] Other

MA
[ ] MCP Certification
[ ] GW-1 [ ] MWRA eSMART
[ ] GW-2 [ ] S-1 10% CALC
[ ] GW-3
[ ] S-1 GW-1 [ ] S-1 GW-2 [ ] S-1 GW-3
[ ] S-2 GW-1 [ ] S-2 GW-2 [ ] S-2 GW-3
[ ] S-3 GW-1 [ ] S-3 GW-2 [ ] S-3 GW-3
[ ] SW Protection

State where samples were collected: CT

Data Format
[ ] Excel
[X] PDF
[ ] GIS/Key
[ ] EQuIS
[X] Other EnviroData

Data Package
[ ] Tier II Checklist
[ ] Full Data Package*
[ ] Phoenix Std Report
[ ] Other

* SURCHARGE APPLIES

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Work of the Contract is shown and described in Drawings and Project Manual entitled:

Town of Vernon
Exit 67 Sewer Extension

Tighe & Bond, Inc.
Consulting Engineers
Shelton, CT

2. The Work includes the following major items:

a. 5,420 linear feet of new sanitary sewer gravity main.
b. New precast concrete manholes.
c. Modifications to existing manholes.
d. Individual sanitary sewer laterals within the road right of way.
e. 2,100 linear feet of new sanitary sewer force main.
f. New Sanitary sewer pumping station.
g. Bituminous concrete pavement repair.

B. Related Requirements

1. Section 00800 - Supplementary Conditions

1.2 SUBMITTALS

A. Informational Submittals: Submit copies of permits or approvals required for the Work, prior to initiating the Work.

1.3 EXISTING SYSTEM DESCRIPTION

A. The new gravity sewer will connect to the new pumping station and the new sewer force main will connect to an existing 18-inch gravity sewer main. The location of the existing sewer manhole is shown on the Drawings.

1.4 PROJECT/SITE CONDITIONS

A. Permits

1. Comply with requirements of the Vernon Inland Wetlands Approval letter, a copy of which is attached to these specifications.

2. Obtain the permits and approvals listed below:

a. Encroachment permit from the Connecticut Department of Transportation.

3. Obtain required time extensions to permits obtained by the Contractor, if construction authorized by permits has not been completed by the expiration date noted on these permits.

4. Obtain permits and approvals from appropriate jurisdictional agencies and property owners for use of premises not furnished by the Owner, and for all off-site areas.

5. Submit copies of permits prior to performance of Work authorized by permits.

B. Existing Conditions

1. Use of Premises and Off-site Work

a. Limits of Work are defined as the existing road right of way as shown on the Drawings.

b. Obtain permits and approvals for use of any land and access thereto that is deemed necessary for the Work, where such land is not available for use by the Owner, including land for temporary construction facilities, access and egress, or for storage of materials. Confine apparatus and storage to such additional areas.

c. Obtain permits and written approvals from appropriate jurisdictional agencies for the use of premises not available for use by the Owner, including all offsite staging areas, borrow pits and waste areas. Submit copies of all permits and approvals to the Owner prior to using areas.

d. Provide for the disposal of waste materials off-site in accordance with all applicable laws.

e. Adhere to the limits of Work and traffic control plans as indicated, to minimize obstruction to traffic and inconvenience to the Owner, general public, and residents in the vicinity of the Work, and to protect people and property. Keep fire hydrants on or adjacent to the Work accessible to fire fighting equipment at all times.

f. Make temporary provisions for the use of sidewalks and maintain functioning gutters, stormwater systems, drainage ditches, and culverts.

g. Maintain public access to businesses and residences including driveways and parking lots at all times during the Work.

2. Other Work at the Site

a. Water main replacement work by Connecticut Water Company is expected to take place within the project area while the new sewers are under construction. Contractor will need to coordinate work with Water Company Contractor to avoid conflicts. Specifics to be discussed at preconstruction meeting.

PART 2 PRODUCTS

2.1 MATERIALS FURNISHED BY OWNER

A. The Owner will not furnish any materials, labor or equipment under this Contract.

PART 3 EXECUTION – NOT USED

END OF SECTION

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

DISTRICT I
1107 Cromwell Avenue
Rocky Hill, CT 06067

Phone: (860) 258-4502

May 8, 2023

VIA E-Mail
Ms. Lori Carriero
lacarriero@tighebond.com
Tighe & Bond, Inc.
1000 Bridgeport Ave. Suite 32
Shelton, CT 06484

Dear Ms. Carriero:

Subject: Sewer extension Exit 67
Reservoir Rd. (Rt. 31)
Vernon, CT.

We have accepted your plans for the above-noted subject received on April 21, 2023, entitled "Town of Vernon, CT Exit 67 Sewer Extension Project".

An encroachment permit will be issued upon receipt of the following:

1. A completed encroachment permit application needs to be submitted (State form PMT-1 Rev.10/18). ***No work on or affecting state property is to begin until an encroachment permit is issued.***
2. A bond (State form CLA-5 Rev. 8/00) in the amount $500,000.00 in the contractor's name.
3. A Certificate of Insurance requiring Bodily Injury Liability of $1,000,000 and Aggregate of $2,000,000.
4. A check or money order in the amount $100.00 made payable to "Treasure – State of Connecticut".

This approval is good for only two years from the above date.

If you have any questions concerning this matter, please contact Mr. Timothy Isyk of this office at (860) 258-4541.

Very truly yours,

Daniel A. DiReinzo
Special Services Section Manager
Bureau of Highway Operation

Jose Torres/cm
Cc: Town of Vernon Planning and Zoning

TOWN OF VERNON

OFFICE OF THE
TOWN PLANNER

55 West Main St., VERNON, CT 06066
Tel: 860-870-3640
E-Mail: astephens@vernon-ct.gov

Mr. Robert Grasis
Town of Vernon - WPCA
14 Park Place
Vernon, CT

December 5, 2023

RE: **Wetland Agent Approval for 168 Mile Hill Rd - WA-2023-24**

Dear Mr. Grasis,

I have received your Inland Wetlands application (WA-2023-24) for the above listed address. This application is requesting a Wetland Agent Approval for the work proposed within 100' of wetland boundaries. Specifically, you have asked for permission for the 'Exit 67 Sewer Extension Project.' The project consists of 5,600 gravity sewer main, 1,200 feet of sewer service laterals, a sewer pump station building, and 2,100 feet of force sewer main.

I have reviewed the proposed location for this project and it is my opinion that the proposed site work will have no present or future impacts to the adjacent wetlands provided proper erosion and sedimentation controls are put in place during construction. This can include hay bales or silt fencing. **Please contact Craig Perry at 860-870-3638 or cperry@vernon-ct.gov to let him know when E&S controls are in place so the controls can be inspected.**

Subsequently, I approve this work as the Wetland Agent for the Town of Vernon in accordance with CT General Statutes 22a-36 thru 22a-45 provided erosion and sediment controls. are in place **prior** to any work being performed.

Sincerely,

Ashley Stephens
Town Planner/ Wetlands Agent

File: WA-2023-24 Wetlands Agent

23-24 IWC Permit -WA

SECTION 01140

WORK RESTRICTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Work Schedule
2. Construction Constraints
3. Vehicle Access
4. Available Work Area

B. Related Requirements

1. Section 01310 - Coordination
2. Section 01325 - Scheduling of Construction

1.2 SUBMITTALS

A. Incorporate the requirements of this Section in the project schedule submitted under Section 01325.

1.3 WORK SCHEDULE

A. Conduct the Work during daylight hours on Monday through Friday, and within the time between 7:00 a.m. and 5:00 p.m., as modified by the requirements of the CTDOT Encroachment permit. No work is to be done on Owner's holidays, Saturdays, Sundays or outside of the work hours described above. No equipment or machinery may be started at the sites before 8:00 a.m. and all equipment must be shut off by 4:00 p.m.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CONSTRUCTION CONSTRAINTS

A. The following are constraints for the Work. Incorporate these constraints into the schedule required to be submitted under Section 01325.

1. All components of the existing sewer system must remain in operation throughout the work.

3.2 AVAILABLE WORK AREA

A. Limits of construction are defined as the existing road right of way. No work will be permitted to be performed outside these boundaries.

3.3 OTHER WORK AT THE SITE

A. Coordinate with water main replacement work being conducted by Connecticut Water Company as necessary.

END OF SECTION

SECTION 01270

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 DIVISION 0 AND DIVISION 1 WORK INCIDENTAL TO THE CONTRACT PRICE

A. No separate measurement or payment will be made for Work called for in Division 0 or Division 1 of the Specifications, unless specifically covered under the Bid items listed below. All costs associated with this Work will be considered incidental to the Contract Bid price.

B. Division 2 Work will be measured and paid for at the Contractor's unit Bid price or lump sum item cost as indicated on the Bid form. Those payable Work items, and related prices as Bid, will be the basis for all compensation to the Contractor for Work performed under this Contract. Work not specifically included as a Bid item, but which is required to properly and satisfactorily complete the Work is considered ancillary and incidental to the Bid item Work, and payment for such Work is considered to be included in the values as Bid for payable items. Compensation for all unit Bid price Work will be made based on the measured quantity of Work under the appropriate Bid items.

1.2 MOBILIZATION AND DEMOBILIZATION (ITEM 1)

A. Measurement

1. There will be no measurement for the mobilization and demobilization to the Site as this Work will be on a lump sum basis.

B. Payment

1. Payment of the lump sum Bid price will be paid in two equal installments. The first installment will occur at the time the first payment requisition is submitted after the Contractor has initiated full-time construction activity. Payment for the second installment will be included in the first payment request after Substantial Completion has been reached and all equipment has been removed from the Site. In no case will the total of both installments exceed 5 percent of the base Bid price.

1.3 TRAFFIC CONTROL (ITEM 2)

A. Measurement

1. There will be no measurement for traffic control as this Work will be on a lump sum basis.

B. Payment

1. Payment of the lump sum Bid price will be full compensation for all labor, equipment and materials required for or incidental to the traffic control Work, in accordance with the traffic control plans and as may be required by the Town of Vernon or CTDOT. This includes furnishing all cones, signs and miscellaneous equipment, as well as costs associated with the coordination/scheduling of certified flaggers, if required and approved by the Owner.

2. Payments will be made on a monthly basis as a percentage of the lump sum Bid and the amount of Work for that particular month.

1.4 SEDIMENT AND EROSION CONTROL (ITEM 3)

A. Measurement

1. There will be no measurement for sediment and erosion control as this Work will be on a lump sum basis.

B. Payment

1. Payment of the lump sum Bid price will be full compensation for all labor, equipment and materials required for or incidental to sediment and erosion control work including installation of haybales, catch basin silt sacks and other requirements as outlined on the Drawings or as required by the Town.

2. Payments will be made on a monthly basis as a percentage of the lump sum Bid and the amount of Work for that particular month.

1.5 TEST PITS (ITEM 4)

A. Measurement

1. Measurement for test pits will be on a cubic yard basis as approved and measured in the field by the Engineer.

B. Payment

1. Payment of the Bid price for test pits will be full compensation for all cutting of surfaces, excavation, backfill, compaction, dewatering, sheeting and bracing, required measurements, and all labor, equipment and materials required for incidental to the Work.

2. Test pits shall only be performed where approved by the Town if necessary to verify utility locations.

1.6 EXCAVATION BELOW NORMAL GRADE (ITEM 5)

A. Measurement

1. Measurement for excavation below normal grade of unsuitable material will be on a cubic yard basis of earth excavated below the normal grade of excavation to install the pipeline as approved and measured by the Engineer. Measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

2. The normal grade is defined as the stone bedding subgrade.

B. Payment

1. Payment of the Bid price for below invert grade excavation will be full compensation for all excavation, removal and proper off-site disposal of the material, placing and removing sheeting or bracing, and all labor, equipment and materials required for or incidental to the Work.

2. Excavation and disposal (where applicable) of material removed to install pipe bedding from the ground surface to the pipe bedding is included under the pipeline installation bid items.

1.7 MISCELLANEOUS CONCRETE (ITEM 6)

A. Measurement

1. Measurement for concrete for miscellaneous purposes including but not limited to concrete encasement of pipes will be on a cubic yard basis, as approved by the Engineer.

B. Payment

1. Payment of the Bid price for miscellaneous concrete will be full compensation for the incremental cost of providing the concrete including all labor, equipment and materials required for or incidental to the Work.

1.8 ROCK EXCAVATION (ITEM 7)

A. Measurement

1. Measurement for rock excavation will be on a cubic yard basis as measured in the field by the Engineer. Measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

2. Payment for rock excavation shall only be made for the rock removal necessary to obtain the necessary clearances within the existing trench.

3. Rock with earth overburden shall be stripped of earth and exposed so that the rock can be profiled prior to removal. No payment will be made for excavation between the surface and the top of rock.

B. Payment

1. Payment of the Bid price for rock excavation will be full compensation for all excavation, backfill, compaction, removal and proper off-site disposal of the material, and all labor, equipment and materials required for or incidental to the Work.

2. Boulders less than 1 cubic yard will be paid for as earth excavation and not paid for as part of rock excavation.

3. Payment for rock excavation will be at the Bid price regardless of the depth at which it is encountered.

1.9 CRUSHED STONE BEDDING (ITEM 8)

A. Measurement

1. Measurement for crushed stone bedding to replace excavated unsuitable material underneath the pipe bedding will be made on a cubic yard basis. The depth gravel will be actual depth placed in the completed Work, but in no case will this exceed the depth approved by the Engineer. Width measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

2. Payment of the Bid price for crushed stone bedding will be full compensation for furnishing, hauling, placing, spreading, and compacting, and includes all labor, equipment, and materials required for or incidental to the Work.

1.10 ORDINARY BORROW (ITEM 9)

A. Measurement

1. Measurement for ordinary borrow will be on a cubic yard basis. The depth of ordinary borrow will be actual depth placed in the completed Work, but in no case will this exceed the depth approved by the Engineer. Width measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

B. Payment

1. Payment of the Bid price for ordinary borrow will be full compensation for furnishing, hauling, placing, spreading, and compacting, and includes all labor, equipment, and materials required for or incidental to the Work.

1.11 8" PVC GRAVITY SEWER MAIN (ITEMS 10, 10A, 10B)

A. Measurement

1. Measurement for 8" PVC gravity sewer main will be on a linear foot basis and will be along the ground surface above and parallel to the pipe, from and to the inside face of structures.

B. Payment

1. Payment of the Bid price for PVC gravity sewer main will be full compensation for all pavement cutting, trench support, excavation, backfilling, and compaction; gravel pipe bedding and stone over the pipe; dewatering; core-drilling existing manholes, furnishing and placing pipe, manhole connection couplings and underground warning tape; testing, television inspection, and all labor, equipment, and materials required for or incidental to the Work.

Bid Item 10 is for PVC sewer main less than 10' deep.

Bid Item 10A is for PVC sewer main from 10-15' deep

Bid Item 10B is for PVC sewer main greater than 15' deep

1.12 PRECAST CONCRETE MANHOLES (ITEMS 11, 11A, 11B)

A. Measurement

1. Measurement for precast concrete sewer manholes will be a unit price per each basis based upon a count of the number of precast concrete sewer manholes provided. Manhole depth shall be measured from the bottom of the manhole base to the top of the manhole frame and cover.

B. Payment

1. Payment of the Bid price for each precast concrete sewer manholes will be full compensation for the structure, frame and cover, invert, installation, testing, adjustment of frame and cover prior to paving, and all labor, equipment and materials required for or incidental to the Work.

2. Bid Item 11 is for manholes less than 10' deep

Bid Item 11A is for manholes from 10-15' deep

Bid Item 11B is for manholes greater than 15' deep

1.13 MODIFICATIONS TO EXISTING MANHOLE (ITEM 12)

A. Measurement

1. Measurement for modifications to existing manholes will be a unit price per each basis based upon a count of the number of manholes modified.

B. Payment

1. Payment of the Bid price for modifications to an existing manhole will be full compensation for manhole coring, flexible connectors, pipe and fitting installation, masonry repair of manhole wall and invert, and bypassing/maintenance of flow in the existing sewer system, all labor, equipment and materials required for or incidental to the Work.

1.14 EXISTING SEWER AND MANHOLE CLEANING AND INVESTIGATION (ITEM 13)

A. Measurement

1. There will be no measurement for existing sewer and manhole cleaning as this Work will be on a lump sum basis.

B. Payment

1. Payment of the Bid price for existing sewer and manhole cleaning/investigation will be full compensation for all sewer manhole cleaning and pipeline cleaning and video inspection as shown on the Drawings, all labor, equipment and materials required for or incidental to the Work.

1.15 SANITARY SEWER LATERALS (ITEM 14)

A. Measurement

1. Measurement for sanitary sewer laterals will be on a linear foot basis from the new sewer main to the edge of the road ROW line as approved by the Engineer.

B. Payment

1. Payment of the Bid price for sewer laterals will be full compensation for all pavement cutting, trench support, excavation, backfilling, and compaction; gravel pipe bedding and stone over the pipe; dewatering; furnishing and placing pipe, transition fittings and/or adaptors, underground warning tape; testing, and all labor, equipment and materials required for or incidental to the Work.

1.16 6" DUCTILE IRON FORCE SEWER MAIN (ITEM 15)

A. Measurement

1. Measurement for 6" ductile iron force sewer main will be on a linear foot basis and will be along the ground surface above and parallel to the pipe, from and to the inside face of structures.

B. Payment

1. Payment of the Bid price for ductile iron force sewer main will be full compensation for all pavement cutting, trench support, excavation, backfilling, and compaction; gravel pipe bedding and stone over the pipe; dewatering, furnishing and placing pipe, underground warning tape; testing, and all labor, equipment, and materials required for or incidental to the Work.

1.17 ASPHALT CONCRETE CURB (ITEM 16)

A. Measurement

1. Measurement for bituminous concrete curb will be on a linear foot basis as measured in the field by the Engineer. The length of curb will be the actual length of curb replaced. Curb replacement shall only take place where directed by the Town of Vernon and/or the CTDOT.

B. Payment

1. Payment of the Bid price for bituminous concrete curb, gravel subbase, and all required backup material (gravel or loaming and seeding) will be full compensation for all labor, equipment and materials required for or incidental to the Work.

1.18 BITUMINOUS CONCRETE DRIVEWAY AND SIDEWALK REPAIR (ITEM 17)

A. Measurement

1. The unit of measurement for bituminous concrete driveway and sidewalk trench repair shall be square yard.

2. The payable square yardage over pipe will be calculated using the actual length of pipe installed and the actual width of the trench, up to the allowable pay width as defined in the "Trench Paylines" detail. In no case shall overlapping longitudinal trench repairs be measured more than once.

3. Receipts for the bituminous concrete will be collected by the Engineer to confirm the thickness of the bituminous concrete placed.

4. Shimming to provide a uniform surface flush with the existing pavement grade will not be measured for payment and shall be considered incidental to this item.

B. Payment

1. Payment of the Bid price for temporary bituminous concrete driveway and sidewalk trench repair will be full compensation for furnishing, hauling, placing, spreading, and compacting the bituminous concrete, adjustment of all surface structures (manhole frames/covers, catch basin frames/grates, water gates, gas gates, etc.) as required, and all labor, equipment and materials required for or incidental to the Work.

1.19 BANK RUN GRAVEL SUBBASE (ITEM 18)

A. Measurement

1. Measurement for processed aggregate subbase will be on a cubic yard basis. The depth of processed aggregate subbase shall be the actual depth placed in the completed Work, but in no case shall this exceed the depth approved by the Engineer. Width measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

B. Payment

1. Payment of the Bid price for processed aggregate subbase will be full compensation for furnishing, hauling, placing, spreading, and compacting, and include all labor, equipment and materials required for or incidental to the Work.

1.20 PROCESSED AGGREGATE SUBBASE (ITEM 19)

A. Measurement

1. Measurement for processed aggregate subbase will be on a cubic yard basis. The depth of processed aggregate subbase shall be the actual depth placed in the completed Work, but in no case shall this exceed the depth approved by the Engineer. Width measurement limits for payment purposes shall be as shown on the "Trench Paylines" Detail on the Drawings.

B. Payment

1. Payment of the Bid price for processed aggregate subbase will be full compensation for furnishing, hauling, placing, spreading, and compacting, and include all labor, equipment and materials required for or incidental to the Work.

1.21 STATE ROAD TEMPORARY BITUMINOUS CONCRETE PAVEMENT REPAIR, 4" SUPERPAVE 0.5 (ITEM 20)

A. Measurement

1. Measurement for State Road temporary bituminous concrete pavement repair will be on a unit price per ton basis as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the "Trench Paylines Detail" on the Drawings.

B. Payment

1. Payment of the Bid price for State Road temporary bituminous concrete pavement repair will be full compensation for furnishing, hauling, placing, spreading, and compacting the temporary bituminous concrete, and all labor, equipment and materials required for or incidental to the Work.

1.22 LOCAL ROAD TEMPORARY BITUMINOUS CONCRETE PAVEMENT REPAIR, 2" SUPERPAVE 0.375 (ITEM 21)

A. Measurement

1. Measurement for Local Road temporary bituminous concrete pavement repair will be on a unit price per ton basis as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the "Trench Paylines Detail" on the Drawings.

B. Payment

1. Payment of the Bid price for Local Road temporary bituminous concrete pavement repair will be full compensation for furnishing, hauling, placing, spreading, and compacting the temporary bituminous concrete, and all labor, equipment and materials required for or incidental to the Work.

1.23 STATE ROAD PERMANENT BITUMINOUS CONCRETE PAVEMENT TRENCH REPAIR, ONE 3" COURSE SUPERPAVE 1.0 (ITEM 22)

A. Measurement

1. Measurement for State Road permanent bituminous concrete pavement repair will be on a unit price per ton basis as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the "Trench Paylines" Detail on the Drawings.

B. Payment

1. Payment of the Bid price for State Road permanent bituminous concrete pavement repair will be full compensation for saw cutting and removal of the temporary repair and excess gravel subbase, preparation of the sub base, and furnishing, hauling, placing, spreading, and compacting the bituminous concrete, including all labor, equipment and materials required for or incidental to the Work.

2. Payment shall be made for each of the two 3" layers made at the unit price shown in the Schedule of Bid Items.

1.24 STATE ROAD PERMANENT BITUMINOUS CONCRETE PAVEMENT REPAIR: TWO 1 ½" COURSE SUPERPAVE 0.5 (ITEM 23)

A. Measurement

1. Measurement for State Road permanent bituminous concrete pavement repair will be on a unit price per ton basis as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the "Trench Paylines" Detail on the Drawings.

B. Payment

1. Payment of the Bid price for State Road permanent bituminous concrete pavement repair will be full compensation for placement of tack coat, preparation of the sub base, and furnishing, hauling, placing, spreading, and compacting the bituminous concrete, including all labor, equipment and materials required for or incidental to the Work.

2. Payment shall be made once for both of the 1 ½" layers of S0.5 pavement to be installed.

1.25 LOCAL ROAD PERMANENT BITUMINOUS CONCRETE PAVEMENT REPAIR: ONE 2" COURSE SUPERPAVE 0.375 (ITEM 24)

A. Measurement

1. Measurement for Local Road permanent bituminous concrete pavement repair will be on a unit price per ton as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the Drawings.

B. Payment

1. Payment of the Bid price for Local Road permanent bituminous concrete pavement repair will be full compensation for placement of tack coat, preparation of the sub base, and furnishing, hauling, placing, spreading, and compacting the bituminous concrete, including all labor, equipment and materials required for or incidental to the Work.

1.26 LOCAL ROAD PERMANENT BITUMINOUS CONCRETE PAVEMENT REPAIR: ONE 2" COURSE SUPERPAVE 0.5 (ITEM 25)

A. Measurement

1. Measurement for Local Road permanent bituminous concrete pavement repair will be on a unit price per ton basis as measured in the field by the Engineer. The length of the repair will be the actual length of the trench repaired. The width will be the actual width of repair made, but in no case will payment be made for trench repair greater in width than that shown on the Drawings.

B. Payment

1. Payment of the Bid price for Local Road permanent bituminous concrete pavement repair will be full compensation for placement of tack coat, preparation of the sub base, and furnishing, hauling, placing, spreading, and compacting the bituminous concrete, including all labor, equipment and materials required for or incidental to the Work.

1.27 BITUMINOUS CONCRETE MILLING (ITEM 26)

A. Measurement

1. Measurement for bituminous concrete milling will be on a square yard basis as measured in the field by the Engineer. The area will be based on the actual length and width of the milled (cold planed) surface.

B. Payment

1. Payment of the Bid price for bituminous concrete roadway milling completed and accepted in place, will be full compensation for milling work and all labor, equipment, and materials required for or incidental to the Work.

1.28 PERMANENT BITUMINOUS CONCRETE REPAIR: 2" OVERLAY (ITEM 27)

A. Measurement

1. Measurement for permanent bituminous concrete pavement 2" overlay will be on a unit price per ton basis as measured in the field by Engineer. The extent of milling to be confirmed with the CTDOT/Town prior to the start of work.

B. Payment

1. Payment of the Bid price for permanent bituminous concrete pavement milling/2" overlay will be full compensation for milling the existing road surface to the extent shown on the Drawings, preparation of the pavement surface, furnishing, hauling, placing, spreading, and compacting the bituminous concrete overlay to the depths shown on the Permanent Patch Detail, and replacement of all traffic markings including all labor, equipment and materials required for or incidental to the Work.

1.29 GRAVEL ROAD REPAIR (ITEM 28)

A. Measurement

1. Measurement for gravel road repair will be on a square yard basis as measured in the field by the Engineer.

B. Payment

1. Payment of the Bid price for gravel road repair will be full compensation for removal of the temporary repair, preparation of the subbase, furnishing, hauling, placing, spreading, compacting the gravel to the depths shown on the Gravel Road Detail.

1.30 SITE RESTORATION (ITEM 29)

A. Measurement

1. There will be no measurement of quantities for lump sum items. Periodic partial payments for this Work, included under the Agreement, shall be based on the percent completion estimated by the Contractor and approved by the Engineer.

B. Payment

1. Payment of the lump sum Bid price will be full compensation for all labor, equipment and materials required for or incidental to site restoration work including restoration of lawn areas, plantings, mailboxes, shrubs, and any other item related to site restoration within the limits of work which is not covered under other bid items. Payments will be made monthly at the conclusion of the sewer construction as a percentage of the lump sum Bid and the amount of restoration Work for that particular month.

1.31 PUMP STATION (ITEM 30)

A. Measurement

1. There will be no measurement of quantities for lump sum items. Periodic partial payments for this Work, included under the Agreement, shall be based on the percent completion estimated by the Contractor and approved by the Engineer.

B. Payment

1. The lump sum payment shall be full compensation for all excavation, backfill, compaction, dewatering, polluted soils management, furnishing and installing the precast concrete wet well, valve vault, and generator building complete; pumps, generator, fuel tank, new electric service and all electrical interconnections, piping, valves, paving, fencing, plantings, access driveway guardrail modifications, all labor, materials, tools, equipment, and services necessary for the construction of the pump station in its entirety as detailed in the Contract Documents.

2. Payment for SMH RES-14 to be made under Bid Item 18A.

1.32 UTILITY ALLOWANCE (ITEM 31)

A. Measurement

1. Measurement for the utility allowance will be reimbursement of actual costs charged by utility companies associated with providing new gas and electric service to the pump station.

B. Payment

1. Payment will be made upon receipt of a copy of the Utility Company invoices and a copy of the Contractor's check to each company.

1.33 CERTIFIED FLAGGER ALLOWANCE (ITEM 32)

A. Measurement

1. Measurement for certified flaggers used for traffic control on State Roads will be on an hourly basis using the submitted invoices.

2. Contractor will not be allowed to use his own personnel for traffic control reimbursement unless it can be proven that the hourly rate is less than or equal to that rates charged by a certified flagging company as obtained by the Owner.

B. Payment

1. Payment will be made upon receipt of a copy of the invoices and a copy of the Contractor's check to the flagging company.

2. Each invoice shall include the flaggers's name, date, location, hours worked, and wage rate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01310

COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Project Management
2. Coordination
3. Project Meetings

B. Related Requirements

1. Section 01140 - Work Restrictions
2. Section 01325 - Scheduling of Construction

1.2 SUBMITTALS

A. Incorporate the requirements of this Section, as well as Work which may impact the existing system operation, or the operations of any adjacent utility, in the project schedule submitted under Section 01325.

B. Informational Submittals

1. Submit to the affected utility company, the Owner, and the Engineer, in writing, all requests for temporary shutdowns of facilities or interruption of operations. No shutdowns of the sewer system or interruptions to existing operations will be permitted except as outlined in this Section. No shutdown shall occur without the approval of the utility company or the Owner.
2. At the pre-construction conference, supply to the Owner the cell phone number of a responsible person who may be contacted during off-hours for emergencies 24 hours a day, seven days a week.
3. Prepare a contact list of phone numbers, including cell phone numbers, and emails for all Project personnel and submit to the Engineer at the pre-construction conference. Include Contractor, Owner, Engineer, and Town personnel including police, fire, and ambulance.

1.3 PROJECT MANAGEMENT

A. Retain a full-time Superintendent, satisfactory to the Owner and Engineer. The Superintendent shall not be changed except with the consent of the Owner and Engineer. The Superintendent shall be in full charge of the Work.

B. Complete the Work in a continuous uninterrupted operation. Use sufficient personnel and adequate equipment to complete the Work within the Contract Time.

1.4 COORDINATION

A. Do not interfere with the operation of the existing facilities.

B. Perform all coordination necessary to complete connections to the existing manhole.

C. Coordinate with appropriate utility companies, as well as with the Owner, where the Work crosses or is adjacent to existing utilities.

1.5 PROJECT MEETINGS

A. Pre-Construction Conference

1. The Contractor shall be prepared to discuss the following subjects at the Pre-Construction Conference. Documentation for these items is required to be submitted within the time frames included in individual specification sections.

a. Project scheduling

b. Sequencing of critical path Work items

c. Shop Drawing procedures

d. Project changes and clarification procedures

e. Use of sites, access to Work areas, office and storage areas, security and temporary facilities

f. Contractor safety plan and representative

g. Progress payments and procedures

h. Required documentation

i. Project personnel contact list

B. Progress Meetings

1. Progress meetings will be held if requested by the Owner or as required by the Progress of the Work.

2. The Contractor's Superintendent shall attend all progress meetings.

3. At a minimum, progress meetings will review Work progress, schedule, Shop Drawing submission schedule, Applications for Payment, and other matters needing discussion and resolution.

4. Review the schedule with all parties to be affected by upcoming work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Notify Call Before You Dig at 1-800-922-4455 at least 72 hours prior to any digging, trenching, rock removal, demolition, borings, backfill, grading, landscaping, or any other earth moving operations.

3.2 COORDINATION WITH THE OWNER'S OPERATIONS

A. Notify the Owner and Engineer, in writing, a minimum of 1 week in advance of commencing Work on site.

B. Notify the Owner and Engineer, in writing, a minimum of 1 week before commencing any work which may affect the Owner's operations.

C. Perform all construction activities so as to avoid interference with operations of the facility and the work of others.

D. The Owner has the authority to order the Work stopped which could unreasonably result in stopping the necessary functions of the sewer system. Any costs and/or delays associated with these work stoppages due to the Contractor's operation shall be borne by the Contractor.

3.3 SEQUENCE OF CONSTRUCTION

A. Constructing the proposed improvements while maintaining existing operations will require a specific sequence of construction. The Contractor will be allowed reasonable flexibility in scheduling the construction activities. Provide a detailed construction schedule as required in Section 01325.

END OF SECTION

SECTION 01321

COLOR AUDIO-VIDEO DOCUMENTATION SURVEY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Pre-and post-construction color video recording of existing surface features.

1.2 DEFINITIONS

A. Zone of Influence is defined as any area within the immediate construction site which may be affected by equipment traffic, material stockpiles, temporary staging areas including a minimum 200 feet along each side of adjoining streets to the construction site.

1.3 SUBMITTALS

A. Informational Submittals

1. Submit audio-video recording of preconstruction areas in the manner described in this section. Do not commence with construction activities until the recordings are submitted and approved.

2. Video documentation must occur within 2 weeks prior to the start of work on the subject street.

1.4 QUALITY ASSURANCE

A. Documentation shall be performed during times of good visibility when there is no active precipitation or snow cover. The Owner is not responsible for the removal of snow, leaves, debris or parked vehicles.

PART 2 PRODUCTS

2.1 FORMAT

A. Audio-video recording shall be in digital versatile/video disc (DVD) format. Video output from camera(s) used must be capable of producing NTSC-500 lines. Resolution in the Y channel, minimum 500 TV lines at center. Geometric Distortion shall not exceed 2% of picture height at any point in picture area.

2.2 RECORDING INFORMATION

A. The audio-video recording shall have the potential to convey 1 video track and 1 audio track. The video and audio tracks shall be recorded simultaneously as original live recordings and shall not be copies of other audio or video recordings. These recordings shall consist of a fixed elevation video record of the Zone of Influence of construction and the commentary of the videographer making the video record.

B. Video recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording, the engineering stationing corresponding to the stationing on the Drawings or as directed by the Engineer, the name of the street, easement or building being documented, the project name, direction of travel and the viewing side.

C. The date and time shall appear in the upper left hand corner of the picture -- example:

Time 8:35:15

Date 1/26/23

D. The project name shall appear on the lower half of the screen

PART 3 EXECUTION

3.1 CONSTRUCTION AUDIO-VIDEO PROCEDURES

A. Perform initial audio-video documentation prior to the start of on-site construction activities to depict pre-construction conditions.

B. Perform second audio-visual documentation after construction to record post construction conditions.

C. Audio-video documentation shall commence at Station 0+00 and proceed to 100 feet beyond the end of the proposed pipeline route along the pipeline route viewing side to side along the direction of progress.

D. The average rate of speed in the general direction of the conveyance used during recording shall not exceed 50 feet per minute. Panning and zooming rates shall be controlled sufficiently that playback will produce optimum clarity of the objects being viewed.

E. Coverage shall include, but not be limited to, the entire roadway pipeline route, existing driveways, sidewalks, curbs, ditches, streets (including condition of paving for full width), intersections, landscaping, trees, culverts, catch basins, head walls, fences, mailboxes, retaining walls, visible utilities and all buildings and structures located within the Zone of Influence. Include existing faults, fractures, defects or other imperfections exhibited by the above-mentioned surface features.

F. Houses and buildings shall be identified visually by house or building number, when possible, in such manner that the progress of the taping and proposed construction areas may be located by reference to the houses and buildings.

G. Recordings produced under this Contract shall be turned over to the Engineer on an every other day basis so the Owner may review and monitor quality and progress. Any portion of the recording coverage deemed unacceptable by the Owner or Engineer shall be re-recorded at no additional cost to the Owner.

H. DVDs and cases shall be properly identified by recording number, location, project name, and become the property of the Owner. A record of the contents of each DVD shall be supplied by a run sheet identifying each segment in the tape by location, i.e., roll number, street or easement viewing, disc time, viewing side, starting point, traveling direction and ending point.

END OF SECTION

SECTION 01325

SCHEDULING OF CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Progress Schedule

B. Related Requirements

1. Section 01140 - Work Restrictions

2. Section 01310 - Coordination

1.2 PROGRESS SCHEDULE

A. Graphically show the order and interdependence of activities, sequence of Work, how the start of a given activity depends on completion of preceding activities, and how completion of an activity may restrain the start of subsequent activities.

B. The Work shall be planned by the Contractor and his Project field superintendent in coordination with all Subcontractors and Suppliers whose Work is shown on the Progress Schedule.

C. Include, at a minimum, the following activities on the Progress Schedule:

1. Project mobilization

2. Submittal and approval of Shop Drawings

3. Procurement of equipment and critical materials

4. Installation of equipment and critical materials

5. Fabrication of special equipment and material, and its installation and testing

6. Final inspecting and testing

7. Punchlist

8. Final cleanup

9. Other activities that may be critical to the Progress Schedule

10. All activities of the Owner and the Engineer which affect progress and/or affect required dates for completion of the Work

D. Take into consideration Shop Drawing submittal and approval time, the delivery times of equipment and materials, Subcontractors' Work, availability and abilities of workmen, weather conditions, any restrictions in operations at the Work site, and all other items that may affect completion of the Work within the Contract Time.

E. The Progress Schedule shall reflect the requirements and constraints outlined in Section 01310, Coordination.

F. The Progress Schedule shall reflect Work restrictions outlined in Section 01140.

G. Show information in such detail that duration times of activities will range from one to 15 days. The selection and number of activities shall be subject to the approval of the Owner and Engineer.

H. The Progress Schedule should show preceding and following event numbers for each activity, description of each activity, and activity duration in calendar days.

I. Submit the Progress Schedule on maximum sheet size 30-inches high by the width required.

1.3 SUBMITTALS

A. Informational Submittals

1. Submit four prints of the preliminary Progress Schedule prepared in accordance with Article 2.05 of Section 00700 and the requirements of this section. Progress schedule must be submitted within 10 days after the Effective Date of the Agreement. Progress Schedule must be approved by the Owner and Engineer before the first progress payment will be made.

2. Revised analyses - Within 10 days after receipt of the review comments, submit four prints of the Progress Schedule revised in accordance with those comments.

3. Periodic reports - On the first progress meeting of each month, submit four prints of the updated Progress Schedule, as well as a report of construction activities in the prior month.

4. Before initiating the Work, submit an estimated monthly rate of Contractor payments for the project. If the payment schedule deviates from the original projection, submit a revised rate of expenditure schedule.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Action Submittals

2. Informational Submittals

1.2 DEFINITIONS

A. Action Submittals – includes written and graphic information submitted by Contractor that requires Engineer's approval.

B. Informational Submittals – includes information submitted by Contractor that does not require Engineer's approval. The Engineer will acknowledge receipt of such documents and provide comments when the submittals lack the detail required by the Contract Documents.

1.3 ACTION SUBMITTALS

A. Shop Drawings

1. Shop Drawings as defined in the General Conditions, and as specified in individual work sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, schedule information, piece part drawings, actual shop work manufacturing instructions, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certification, as applicable to the Work.

2. Shop Drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions. Approved standard size drawings shall be 8.5 inches by 11 inches

3. Submit Shop Drawings at the proper time to prevent delays in delivery of materials. Coordinate submittals for related or interdependent equipment.

4. Advise the Engineer in writing of any deviations from the requirements of the Contract Documents.

5. Check all Shop Drawings regarding measurements, size of members, materials, and details to determine if they conform to the Contract Documents. Shop Drawings found to be inaccurate, not in compliance, or otherwise in error shall be returned to the Subcontractors or Suppliers for correction before submission to the Engineer. Drawings that are current shall be marked with the date, name, and approval stamp of the Contractor.

6. All details on Shop Drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such

measurements shall be made and noted on the Shop Drawings before being submitted for approval.

7. Detailed installation drawings (sewers, equipment, piping, electrical conduits and controls, HVAC work, and plumbing, etc.) shall be drawn to scale and fully dimensioned.

8. No material or equipment shall be purchased or fabricated until the required Shop Drawings have been submitted and approved. Materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by the Shop Drawings.

9. Until the necessary approval has been given, do not proceed with any portion of the work, the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which approval is required.

10. If submitted equipment requires modifications to the structures, piping, layout, or other details shown on the Drawings, details of the proposed modifications must also be submitted for approval. If such equipment and modifications are approved, perform all Work necessary to make such modifications at no additional cost to the Owner.

B. Product Data: Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

C. Samples and color selection charts: Provide sample, when requested by individual Specification to establish conformance with the Specifications, and as necessary to define color, texture and pattern selections available.

1.4 INFORMATIONAL SUBMITTALS

A. Schedule of Submittals

1. Submit a preliminary Schedule of Submittals within 10 days of the Effective Date of the Agreement in accordance with Article 2.05 of Section 00700.

B. Schedule of Manufacturers and Suppliers

1. Submit a schedule of manufacturers and Suppliers within 7 days after Notice to Proceed including the names and addresses of the manufacturers and Suppliers of materials and equipment to be incorporated into the Work.

C. Schedule of Major Products

1. Submit a schedule of major products within 30 days after Notice to Proceed including a complete list of major products proposed for use, with specification section number, name of manufacturer, trade name, and model number of each product.

D. Certificates of Compliance

1. General:

a. Submit sworn certificates from the manufacturer or material supplier that the materials and fabrications provided under the Specification section conform with the Contract Documents.

b. Certificates shall be signed by an officer of the manufacturer's corporation and witnessed by a Notary Public.

2. Welding: Submit in accordance with individual Specification sections.

3. Installer: Prepare written statements on manufacturer's letterhead certifying that installer complies with requirements as specified in individual Specification sections.

4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency, or when specified in individual Specification sections.

6. Manufacturer's Certificate of Compliance: In accordance with individual Specification sections.

E. Application for Payment

1. Submit applications for payment in accordance with Section 01270, Measurement and Payment or Section 01290, Application and Certificate for Payment.

2. Submit schedule of stored materials when requesting payment for materials not yet installed.

F. Construction Photography and Videography: Provide preconstruction, progress, and post-construction photography and videography in accordance with Section 01321.

G. Contract Closeout Submittals: In accordance with Section 01770.

H. Contractor Design Data

1. Written and graphic information

2. List of assumptions

3. List of performance and design criteria

4. Summary of loads or load diagram

5. Calculations

6. List of applicable codes and regulations

7. Name and version of software

8. Information requested in individual Specification section

I. Schedules - Submit construction progress schedules and schedule updates in accordance with Section 01325.

J. Statement of Qualifications: Submit evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty subcontractor, trade, specialist, consultant, installer, and other professionals.

K. Submittals Required by Laws, Regulations, and Governing Agencies

1. Submit promptly notifications, reports, certifications, payrolls, and other required information as may be required, directly to the applicable federal, state, or local governing agency or their representative.

2. Transmit to Engineer for Owner's records, one copy of correspondence and transmittals (including enclosures and attachments) between Contractor and governing agency.

L. Test and Inspection Reports

1. Submit test and inspection reports as required by individual Specification sections.

2. Test and inspection reports shall contain signature of person responsible for test or report.

3. Reports shall include identification of product and Specification, project name, date and time of test, type of test, location, test results, corrective action required if report indicates test is not in compliance with Contract Documents, interpretation of test results, and other information as required in individual Specification sections.

M. Equipment Data: Submit information on equipment to be used in the performance of the Work as required by individual Specification sections.

N. Testing and Start-up Data: Prepare and submit testing procedures proposed to perform testing required by individual Specification sections.

O. Health & Safety Plans: When specified in individual Specification sections, prepare and submit a Health and Safety Plan modified or supplemented to include job-specific considerations.

P. Submittals stamped by another Professional Engineer: When specified in individual Specification sections, prepare and submit calculations and/or drawings stamped by a Professional Engineer licensed in the State where the work is being performed.

Q. Erosion Control Plan: When specified in Contract Documents or required by local ordinances or regulations, prepare and submit copies of erosion control plans.

R. Traffic Control Plan: When specified in Contract Documents or required by local ordinances or regulations, prepare and submit copies of traffic control plans.

S. Shutdown Requests: Submit notification of any outages required (electrical, flow processes, etc.) as may be required to tie-in new work into existing facilities. Unless otherwise specified, provide outage requests a minimum of 7 days' notice shall be provided.

T. Equipment Data: When specified in other Specification sections, information on equipment used by the Contractor to complete the Work, such as compaction equipment and closed-circuit television inspection equipment.

1.5 PROCEDURES

A. Coordination

1. Prepare and submit documentation in advance of fabrication and product manufacturer, so that the installation will not be delayed, other related work can be properly coordinated, and there is adequate time for review and resubmission, if required.

2. Provide no less than 30 days for review of submittals from the time received by the Engineer. For submittals of major equipment, that require more than 30 days to review, due to complexity and detail or those requiring review by multiple engineering disciplines, Engineer will notify Contractor of the circumstances and identify the anticipated date when the submittal will be returned.

3. Re-submittals will be subject to same review time.

4. No extension of time will be authorized due to failure to provide approvable submittals sufficiently in advance of the Work.

B. Review Shop Drawings, product data, and samples prior to submission and verify and determine:

1. Field measurements

2. Conformance with the Contract Documents. Advise the Engineer in writing of any deviations from the requirements of the Contract Documents.

3. Delete or strike out information that is not applicable to the Work.

C. Upload the electronic submittal files via Procore. Access to Procore will be provided by the Engineer. Files must be in .pdf format. The submittals will be returned in electronic .pdf format via Procore.

D. Numbering: Submissions shall be accompanied by a transmittal form referencing the project name and applicable Specification section. Submittals shall be numbered sequentially, with the applicable Specification section and a hyphen preceding the number. (*e.g.* Submittal number 11330-01). Resubmittals shall bear the same transmittal number with a revision number commencing with "1" (*e.g.* Submittal number 11330-01-1).

E. Provide a copy of the Submittal Certification Form (copy attached at the end of this section) which shall be attached to every copy of each submittal as required under Article 7.16 A.2 of Section 00700. Apply the Contractor's stamp and initials or signature certifying that the submission has been thoroughly reviewed for completeness, compliance with the Contract Documents, coordination with adjacent construction and dimensional compatibility. Items submitted without the stamp or that are incomplete will be returned by the Engineer for rework and resubmission.

F. Provide a copy of the PE Certification Form (copy attached at the end of this section) which shall be attached to every copy of each submittal stamped by another Professional Engineer. Items submitted without the completed certification form will be returned by the Engineer for resubmission.

G. Distribute copies of reviewed submittals along with the Engineer's transmittal to concerned parties with instructions to promptly report any inability to comply with the provisions or integrate the requirements with interfacing work.

H. Partial and Incomplete Submittals

1. Shop Drawings shall be submitted as a complete package by Specification section, unless otherwise reviewed and approved by the Engineer. It is the intent that all information, materials, and samples associated with each Specification section be included as a single submittal for the Engineer's review.

2. Engineer will return entire submittals if preliminary review deems it incomplete including:

a. Missing or incomplete Submittal Certification Form

b. Insufficient number of copies

c. Missing content

3. Partial submittals may be considered, at Engineer's option, only when necessary to expedite the Project.

4. Partial submittals shall be clearly identified as such on the transmittal to identify missing components.

I. Submittals not required by the Specification will be returned without review or action code.

J. Resubmission

1. Make corrections and modifications required by the Engineer and resubmit until approved.

2. Clearly identify changes made to submittals and indicate other changes that have been made other than those requested by the Engineer.

3. A maximum of two re-submissions of each shop drawing will be reviewed, checked and commented upon without charge to the Contractor (total of 3 submittals). Any additional submissions which are required by the Engineer to fulfill the stipulations of the Contract Documents will be charged to the Contractor as described in paragraph 7.16.E.2 of Section 00700.

K. Distribution

1. Distribute approved Shop Drawings and approved product data to the Project Site and elsewhere as required to communicate the information to Suppliers, Subcontractors, and field personnel.

1.6 ENGINEER'S REVIEW

A. The Engineer will review submittals for design, general methods of construction and detailing. The Engineer's review and approval of submittals shall not be construed as a complete check nor does it relieve the Contractor from responsibility for any departures or deviations from the requirements of the Contract Documents unless he has, in writing, called the Engineer's attention to such deviations at the time of submission. It will not extend to means, methods, technique, sequences, or procedures

of construction (except where specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto.

B. The Engineer's review of the submittals shall not relieve the Contractor from the responsibility for proper fitting of the Work, or the responsibility of furnishing any work required by the Contract Documents which may not be indicated on the submittals. The Contractor shall be solely responsible for any quantities shown on the submittals.

C. If the Contractor considers any correction indicated on the submittals to constitute a change to the Contract Documents, the Contractor shall provide written notice to the Engineer at least 7 working days prior to release for manufacture.

D. When the submittals have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

E. Action submittals as defined in paragraph 1.2 will be reviewed and returned under one of the following codes:

1. Approved (Action Code 1) is assigned when there are no notations or comments on the submittal. Equipment or materials may be released for manufacture, provided that it complies with requirements of the Contract Documents.

2. Approved as Noted (Action Code 2) is assigned when there are notations or comments on the submittal, but the equipment or materials may still be released for manufacture. All notations and comments must be incorporated in the final product. Resubmission is not necessary.

3. Revise and Resubmit (Action Code 3) is assigned when there are notations and comments requiring a resubmittal of the package. Work cannot proceed until the submittal is revised and resubmitted for review.

4. Not Approved (Action Code 4) is assigned when the submittal contains non-specified items or does not meet the requirements of the Contract Documents. It may also be assigned when there is a significant amount of missing material required for the Engineer to perform a complete review. The entire package must be resubmitted, revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the Contract Documents.

F. Informational submittals as defined in paragraph 1.2 do not require approval by the Engineer. Such submittals will be returned under one of the following codes:

1. Receipt Acknowledged (Action Code 5) is assigned when the submittal is provided for documentation purposes and is acknowledged as received. Comments may be noted using this action code.

2. Revise and Resubmit (Action Code 6) is assigned when there are notations and comments requiring a resubmittal of the package.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SUBMITTAL CERTIFICATION FORM

PROJECT:_____
ENGINEER:_____ ENGINEER'S PROJECT NO.:_____
CONTRACTOR:_____ CONTRACTOR'S PROJECT NO.:_____

TRANSMITTAL NO.:_____ SUBMITTAL NO.:_____
SPECIFICATION NO.:_____ DRAWING NO:_____
DESCRIPTION:_____
MANUFACTURER:_____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the materials and/or equipment meets or exceeds the project specification requirements; that field measurements, dimensions, quantities, specified performance criteria, installation requirements, materials, catalog numbers and related materials have been verified; that all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the work has been determined and verified; that review includes all information related to the contractor's sole responsibility for means, methods, techniques, sequences, and procedures of construction and safety; and item has been coordinated with the overall project with:

☐ NO DEVIATIONS

☐ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS:

_____
_____
_____
_____
_____
_____

SUBMITTED BY:_____ DATE:_____

GENERAL CONTRACTOR'S STAMP

SECTION 01350

HEALTH & SAFETY PLAN

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall:

1. develop a site-specific Health and Safety Plan (HASP) specifically addressing the potential hazards that may be encountered at the work site. The HASP shall include the information described in this specification (as applicable) and meet all applicable OSHA requirements.

2. furnish all labor, equipment, materials, and employee training for effective implementation of the HASP and worker health and safety protection of all Contractor personnel.

3. furnish all labor, equipment, materials, and employee training to effectively complete any required air monitoring and/or decontamination.

4. review the requirements and data provided for the project and supplement the HASP with any additional measures deemed necessary to fully comply with applicable regulatory requirements and to adequately protect personnel on the site.

5. maintain a copy of the HASP at the worksite, accessible to employees working at the site.

6. post the emergency response plan section of the HASP, inclusive of emergency alerting and response procedures and directions to the nearest hospital, in a visible location for all workers to see.

B. Related Sections

1. Section 02110 Contaminated Soil Excavation

2. Section 02120 Transportation and Disposal of Contaminated Materials

3. Section 02315 Excavation, Backfill, Compaction and Dewatering

1.2 SITE-SPECIFIC PROJECT CONDITIONS

A. The Contractor shall review and understand all existing information as it relates to potential exposure to subsurface site contaminants, environmental data and reports. Reference Section 00800 for copies of applicable environmental data.

B. The nature of the materials present at the site may require use of special protective clothing and the possible use of respiratory protective equipment, which is intended to help minimize worker exposure to known or suspected site hazards.

1. Levels of personal protection are established in reference standards and generally described for Levels C and D herein. It is anticipated that a majority of the Work to be performed on this project may be performed at Personnel Protection Level D.

2. The Contractor shall be responsible for determining if a higher level of personnel protection is required based on the criteria outlined in the Contractor's HASP. In

the event that the Contractor determines that a level of protection higher than Level D is required, the Contractor's personnel shall take the necessary steps outlined in the Contractor's HASP.

3. The Contractor shall notify the Engineer and Owner in writing prior to implementing any upgrades in personal protection. The Engineer will review the Contractor's notification and determine the need to notify other applicable agencies.

1.3 REFERENCES

A. OSHA 29 CFR Part 1910 (General Industry standards)

B. OSHA 29 CFR Part 1926 (Construction Standards)

C. Applicable Connecticut state regulations

D. OSHA Regulation 29 CFR §1926.62 (Lead)

1.4 DEFINITIONS

A. CHMM: Certified Hazardous Materials Manager, as certified by the Institute of Hazardous Materials Management.

B. CIH: Certified Industrial Hygienist, as certified by the American Board of Industrial Hygiene®.

C. CSP: Certified Safety Professional, as certified by the Board of Certified Safety Professionals.

D. Site Safety and Health Official (SSHO): The individual located at a job site who is responsible to the Contractor and has the authority and knowledge necessary to implement the HASP and verify compliance with applicable safety and health requirements.

1.5 SUBMITTALS

A. On-site Work shall not begin until the HASP has been submitted by the Contractor and acknowledged by the Owner/Engineer.

B. Informational Submittals

1. Submit the following within thirty (30) days after the Effective Date of the Agreement.

a. A site-specific HASP, including the information described in this Specification as applicable.

1) The HASP must be reviewed, approved, and signed by Contractor representative, with specific responsibility for safety for the Contracting company.

2) The Engineer's review is only to determine if the HASP is consistent with the minimum requirements of this specification. Engineer has no control over contractor's health & safety and the means and methods of health & safety implementation. Engineer also does not perform health & safety monitoring of Contractor's Work.

3) The review will not determine the adequacy of the HASP to address all potential hazards, as that remains the sole responsibility of the Contractor.

b. Documentation of qualifications and experience of the SSHO.

c. Applicable health and safety training records.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor is solely responsible for the health and safety of workers employed by the Contractor, any subcontractor, vendors/manufacturers, site visitors and anyone directly or indirectly employed by any of them.

B. Provide a designated SSHO for the project.

C. Pre-arrange emergency medical care services at a nearby hospital or medical clinic, including establishment of an emergency notification process and emergency routes of travel.

D. Conduct pre-entry and weekly safety meetings with all site personnel, documenting attendance and topics covered.

E. Develop and implement the site-specific HASP, inclusive of the elements in contained in this specification.

F. For projects where contaminated media are known, likely, or suspected to be encountered:

1. monitor air quality in and around the work area using appropriate air monitoring equipment.

2. develop and implement a respiratory protection program per 29 CFR §1910.134 and 29 CFR §1926.103 for all workers authorized to wear respirators.

3. record all air quality readings and maintain records on site.

4. stop work and/or upgrade respiratory protection or personal protective equipment levels if action levels established in the HASP are exceeded.

5. ensure that the degree and type of respiratory protection provided is protective for the monitored concentrations and individual chemical parameters.

6. lawfully dispose of all personal protective equipment that cannot be decontaminated.

1.7 HEALTH & SAFETY PLAN (HASP) REQUIREMENTS

A. The following items shall be included/addressed in the HASP:

1. a safety and health risk or hazard analysis for each site task and operation in the workplan;

a. a physical hazard evaluation and hazard control plan shall be included covering, but not limited to the following, as applicable:

1) equipment operation;

2) confined space entry;

3) slips, trips, and falls;

4) building collapse;

5) falling debris;

6) encountering unmarked utilities;

7) cold and heat stress;

8) hot work (cutting and welding);

9) drum and container handling;

10) trench and/or excavation entry.

11) Contaminated soil management

2. the employee safety and health training program covering each site task and operation in the workplan.

3. personal protective equipment to be used for each site task and operation in the workplan.

4. site control measures to address visitors, delivery personnel, and to protect the worksite from unauthorized access.

5. Decontamination procedures necessary to minimize transport or cross contamination due to contaminated materials management.

6. an emergency response plan for the safe and effective response to foreseeable emergencies;

a. including, but not limited to the following:

1) a map indicating the route to a nearby hospital or medical clinic for emergency medical care;

2) procedures for emergency medical treatment and first aid;

3) site evacuation routes and procedures;

4) emergency alerting and response procedures.

PART 2 PRODUCTS

2.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. All PPE must conform to the OSHA requirements, as indicated in the previous Reference Standards Section. Various PPE to be furnished by the Contractor under different levels of protection for their own personnel and subcontractor's personnel include, but are not limited to, the following:

1. Level D Protection:

a. Coveralls or Tyvek

b. Gloves

c. Safety boots/shoes

d. Safety glasses

e. Hearing protection (for high noise operations)

f. Hard hat with optional face shield

2. Level C Protection:

a. Air-purifying respirator

b. Chemical protective overalls or Coveralls (e.g., Saran coated Tyvek)

c. Gloves, inner (disposable, surgical type)

d. Gloves, outer (Neoprene, Nitrile, Viton or Butyl)

e. Boots, chemical protective, steel toe and shank (Neoprene or Nitrile)

f. Booties, chemical protective (disposable PVC)

g. Hard hat

h. Face shield (if necessary)

3. Levels B and A represent increased levels of personal protection and are described in the Reference Standards.

4. Contractor is fully responsible for all PPE selection (including the various stages of protection), material types, proper use, maintenance, and continuous monitoring.

PART 3 EXECUTION

3.1 HEALTH AND SAFETY PLANNING AND IMPLEMENTATION

A. Implement the HASP throughout the execution of all applicable work.

B. The Contractor shall perform all monitoring as detailed in the HASP.

C. Contractor(s) shall implement routine health and safety meetings and any follow-up supplemental briefings.

D. Provide applicable health and safety training for all personnel who may come in contact with or be exposed to various dangerous, hazardous, or changing site conditions.

E. Personnel who have not received applicable training and who are not equipped with the required PPE, shall not be permitted access to the site by the Contractor during the course of the work that may result in potential exposures to unsafe or hazardous site conditions.

3.2 PERSONNEL AND EQUIPMENT DECONTAMINATION

A. All equipment shall be provided to the work site free of contamination. Engineer may prohibit from the site any equipment which in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of Contractor's equipment prior to arrival at the site shall be at the expense of Contractor. Contractor is prohibited from decontaminating equipment on the project site which is not thoroughly decontaminated prior to arrival.

B. Contractor shall furnish labor, materials, tools, and equipment for decontamination of all personnel, equipment and supplies which are used to handle contaminated materials.

C. Properly store and dispose of contaminated PPE and all other generated decontamination waste.

3.3 INCIDENT REPORTING

A. The Contractor shall comply with all accident and/or incident reporting requirements, including the following:

1. Should any unforeseen safety-related factor, hazard, or condition become evident during the course of the work, the Contractor must immediately take action to establish, maintain, and secure the site and working conditions. This shall be followed by immediate notice to the Owner and Engineer.

2. If injury to any person on-site occurs, the Contractor shall immediately report the incident to the Owner and Engineer. Corrective actions shall be implemented.

END OF SECTION

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SECTION 01510

TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Temporary electricity
2. Temporary lighting for construction purposes
3. Temporary heating, cooling and ventilation
4. Temporary telephone service
5. Temporary water
6. Temporary fire protection
7. Temporary fuel oil

1.2 QUALITY ASSURANCE

A. Maintain temporary utilities in proper and safe condition throughout the progress of the Work.

1.3 TEMPORARY ELECTRICITY

A. Provide temporary electrical service capable of providing sufficient power throughout the site for both temporary power and temporary lighting for the Work. Temporary electrical service shall include all wiring, breakers, breaker boxes, poles, supports and all other materials necessary for a totally operable system.

B. Pay all charges for temporary electricity.

C. Make all arrangements with the electric service company including all permits, securities and inspections fees to obtain the separately metered temporary services.

D. Furnish and connect the temporary electric service point to the utility and coordinate metering as required.

E. All connection points and distribution systems shall be in conformance with applicable electrical codes, OSHA, and enforcement agencies having jurisdiction.

F. Provide a general power distribution system including all wires, cables, supports, protective devices, transformers, motor starters, etc., as required for a complete electrically protected and safe system to handle construction services.

G. Provide all outlets with circuit breaker protection and comply with ground fault protection requirements of the NEC.

1.4 TEMPORARY LIGHTING

A. Temporary general lighting system shall provide sufficient artificial light so that all Work may be done in a workmanlike manner within enclosed structures and chambers, where there is not sufficient daylight.

B. Temporary general lighting system shall consist of wiring, switches, necessary insulated supports, poles, fixtures, receptacles, lamps, guards, cut-outs, fuses, and other materials necessary for a totally operable system.

1.5 TEMPORARY HEATING, COOLING AND VENTILATING

A. Provide sufficient temporary heating, cooling and ventilating for the interior of all new structures and buildings to assure safe working conditions and that no damage will occur to the Work.

B. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity and to prevent accumulation of dust, fumes, vapors or gases.

1.6 TEMPORARY WATER

A. Water for Construction Purposes

1. The Contractor shall provide water for construction and testing purposes.

1.7 TEMPORARY FIRE PROTECTION

A. Comply with all applicable fire protection and prevention requirements that may be established by Federal, State or local governmental agencies.

B. Prohibit smoking in hazardous areas. Post suitable warning signs in areas that are continuously or intermittently hazardous.

C. Determine the fire protection adequacy of existing facilities related to the Work being performed and have standby fire protection available if needed.

1.8 TEMPORARY FUEL OIL

A. Properly contain, label, and store all petroleum products off the ground with suitable secondary containment.

B. Take all necessary precautions to avoid leakage and spillage of all petroleum products, including lubricating oils.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01520

CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Temporary sanitary and first-aid facilities

1.2 QUALITY ASSURANCE

A. Maintain temporary construction facilities in proper and safe condition throughout the progress of the Work.

1.3 TEMPORARY SANITARY AND FIRST AID FACILITIES

A. Provide suitably enclosed chemical or self-contained toilets for the use of the labor force employed on the Work. Toilets shall be located near the Work sites and secluded from observation insofar as possible. Toilets shall be serviced weekly, kept clean and supplied throughout the course of the Work.

B. Contractor shall enforce proper use of sanitary facilities.

C. Use of the Owner's sanitary facilities by the Contractor is prohibited.

D. Provide a first aid station at the site.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01550

TRAFFIC REGULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Traffic requirements

1.2 PAYMENT PROCEDURES

1. Refer to Section 01270, Measurement and Payment for procedures relating to payment for the Work.

2. Owner will pay for certified flaggers only where required to comply with conditions of DOT permit. Contractor is responsible for scheduling the traffic flaggers, with Owner's approval, and for providing all documentation.

3. Owner will deduct from monies due Contractor for the following abnormal and unreasonable expenses:

a. Contractor caused delays in the prosecution of work that result in hiring traffic officers for more hours than would have been required during normal prosecution of work.

b. Reconstruction and/or reinstallation of any portions of the work, as a result of improper initial installation or defective material, for which traffic officers are required.

c. Traffic officers required at a site where Contractor is not working or outside of Contractor's standard work day as a result of obstructions to traffic that remain in the traveled way.

d. All other incidents resulting from Contractor's operations requiring traffic officers that would not normally be encountered during the progress of a well-organized project employing proper construction methods.

e. When traffic officers are requested for the convenience of Contractor and are not otherwise considered necessary to the work.

1.3 REFERENCES

A. Manual of Uniform Traffic Control Devices, U.S. Department of Transportation

B. State of Connecticut DOT Office of the State, Traffic Administration Regulations, latest revision

1.4 TRAFFIC REQUIREMENTS

A. Adhere to requirements included in DOT Encroachment Permit for all work on State Roads.

B. Adhere to all applicable Vernon Town ordinances that relate to traffic control on Town Streets. Coordinate and meet with Town authorities to review applicable requirements and develop a traffic control plan consistent with referenced documents for approval by the Town authorities.

C. Arrange construction activity so that all streets shall remain open to at least one-way traffic during periods of actual work, and to unimpeded, two-way traffic during all other periods.

D. Traffic control shall be performed in accordance with the Drawings. If Contractor proposes any modifications to this plan, a traffic control plan shall be submitted to Engineer for approval showing traffic control signs, barrels, cones, traffic officers, including detour signs, meeting the approval of Engineer, Owner and local Police Departments in accordance with the Manual of Uniform Traffic Control Devices.

E. Determine the location of each day's work and implement the approved traffic control plan. If the plan requires the use of certified flagmen, Owner approval shall be obtained..

F. Contractor shall have no claim of delay if he does not notify certified flagmen of his scheduled location in time to arrange for flagmen.

G. Hand deliver written notice to individual houses affected by driveway and side road closings or detours a minimum 24 hours in advance. A recommended parking area outside the work limits shall be included in the notice.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01570

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Dust control
2. Drainage and erosion control
3. Haybales and siltation fence
4. Mulch
5. Sediment trapping devices

B. Related Requirements

1. Section 02920 – Lawns and Grasses

1.2 SUBMITTALS

A. Informational Submittals

1. Materials proposed for use in dust control.
2. Haybales, siltation fence, mulch, and sediment trapping devices.

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 daily.

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.

G. Submit for approval materials proposed for use for dust control, prior to start of the Work.

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. 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 the brook or its surrounding wetlands 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 1-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.

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.

D. Perform work in accordance with Town of Vernon Conservation Commission Order of Conditions.

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. Restore the ground surface in brush and/or woodland areas by machine spreading of existing stripped surface soils (loam and humus), liming, fertilizing, seeding and mulching, as well as installing jute netting where required by steep slopes.

D. Salvage existing loam and topsoil and stockpile this material for re-spreading where originally removed. On backfilling, grading shall be returned to preconstruction contours and the stockpile of loam shall be spread over areas disturbed during construction activities.

E. 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.

F. Provide grading, refertilizing, reseeding, remulching and/or netting to maintain the restored areas until the Work is accepted by the Owner.

G. Seed shall be as specified under Section 02920.

3.5 CLEANING

A. Remove any sediment that builds up around the haybales or catchbasins. Clean sediment trapping devices periodically during the Work. Devices shall be cleaned on a weekly basis, or more frequently if the devices become clogged. Clean catch basins that collect sediment as a result of the Work.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Products and Materials
2. Product Delivery Requirements
3. Packaging, Handling and Storage Requirements
4. Inspection of Offsite Work

1.2 QUALITY ASSURANCE

A. Review all contract Drawings and Specifications with respect to specific system characteristics, applicability of materials and equipment for the intended purposes, sizes, orientation, and interface with other systems, both existing and proposed, and certify that the materials and equipment proposed will perform as specified prior to submitting shop drawings.

B. Provide sworn certificates as to quality and quantity of materials where specified or requested by the Engineer.

C. Obtain concurrence of the Engineer prior to processing, fabricating, or delivering material or equipment.

1.3 PRODUCTS AND MATERIALS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by a single manufacturer unless specified otherwise.

B. Use only new and first quality material in the Work. Material shall conform to the requirements of these Specifications and be approved by the Engineer. If, after trial, it is found that sources of supply that have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved materials from other approved sources.

C. Immediately remove defective materials and equipment from the site, at no additional cost to the Owner. The Contractor may be required to furnish sworn certificates as to the quality and quantity of materials before materials are incorporated in the Work.

D. Engineer has the right to approve the source of supply of all material prior to delivery.

1.4 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer’s instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Progressively deliver materials and equipment to the Site so there will be neither delay in progress of the Work nor an accumulation of material that is not to be used within a reasonable time.

E. Deliver products to the Site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to the manufacturer, grade, quality, source, and other pertinent information.

1.5 PACKAGING, HANDLING AND STORAGE REQUIREMENTS

A. Provide storage and handling of all materials and equipment required for the Work.

B. Except as otherwise indicated in the Contract Documents, determine and comply with the manufacturer's recommendations on product storage, handling, and protection. Provide manufacturer's documentation on recommended storage procedures when requested by the Engineer.

C. Properly store and protect all equipment immediately upon its arrival. All equipment shall be stored in a clean, dry, heated, secured, and insured indoor facility satisfactory to the Engineer. Equip drive motors with thermostatically controlled strip heaters. Outdoor storage with plastic, canvas, plywood or other cover will not be allowed except where specific approval for designated items not containing electrical components or bearings is obtained from the Engineer. This approval does not relieve the Contractor of responsibility for proper protection of materials.

D. Familiarize workmen and subcontractors with hazards associated with materials, equipment, and chemicals specified herein and take all necessary safety precautions.

E. Areas available on the construction site for storage of material and equipment shall be as shown on the Drawings or approved by the Owner.

F. Materials and equipment to be incorporated in the Work shall be handled and stored by the manufacturer, fabricator, supplier, and Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.

G. Protect finished surfaces including floor surfaces, stairs, joints, and soffits of passageways from damage until accepted by the Engineer.

H. Promptly remove materials from the site of the Work which have become damaged or are unfit for the use intended or specified. The Contractor will not be compensated for the damaged materials or their removal costs.

I. Handle, haul, and distribute all materials and all surplus materials on the different portions of the Work, as necessary or required. Provide suitable and adequate storage room for materials and equipment during the progress of the Work, and be responsible for the protection, loss of, or damage to materials and equipment furnished, until the final completion and acceptance of the Work.

J. Storage and demurrage charges by transportation companies and vendors shall be borne by the Contractor.

K. All materials and equipment to be incorporated in the Work shall be placed so as to not damage any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Keep materials and equipment neatly piled and compactly stored in such locations as will cause a minimum of inconvenience to the Owner.

L. No material or equipment will be permitted to be stored in any of the Owner's facilities, unless otherwise approved by the Engineer.

M. Do not store material or equipment in any wetland or environmentally sensitive area. Stockpile sites shall be level, devoid of mature stands of natural vegetation, and removed from drainage facilities and features, wetlands, and stream corridors.

N. Contractor shall be fully responsible for loss or damage to stored materials and equipment.

O. No item judged rusty, corroded or otherwise damaged during storage will be accepted. Any electrical or instrumentation item determined by the Engineer to be damaged shall be removed from the Site and replaced by a completely new item in first class condition. Items not properly stored will not be considered for any partial payment.

P. Provide protective and preventive maintenance during storage consisting of manually exercising equipment where required, inspecting mechanical surfaces for signs of corrosion or other damage, lubricating, applying any coatings as recommended by the equipment manufacturer as necessary for its protection and other precautions as necessary to assure proper protection of equipment stored.

Q. Treat ferrous surfaces not receiving finish coats of paint with rust preventive coating and protect non-ferrous metal work and devices with suitable wrappings.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Documentation required for the transfer of the completed Work to the Owner

2. Final Cleaning

1.2 SUBMITTALS

A. Closeout Submittals

1. As-built drawings

2. Operation and maintenance manuals

3. Evidence of payment and release of liens

4. List of Subcontractors, service organizations, and principal vendors

1.3 SUBSTANTIAL COMPLETION

A. Refer to Article 15.03 in 00700, General Conditions, for procedures relating to obtaining Substantial Completion. Refer to 00520, Agreement, for Contract Times.

1.4 PROJECT CLOSEOUT DOCUMENTS

A. As-Built Drawings - Submit as-built drawings for review, approval, or comment. The as-built drawings shall show the completed work, including all deviations from the original Drawings. The as-built drawings shall depict the location of all conduit and devices exterior from the motor control centers, the location of valves, small diameter piping, relocated devices and all field changes.

1. Take swing ties to all underground work from a minimum of two horizontal locations. Vertical dimensions to all below grade work shall also be obtained. All fittings, bends, valves and other appurtenances shall be shown. At a minimum, the following information shall be shown on the as-built drawings for exterior construction.

a. Ties to all buried fittings (including tees, crosses, bends, reducers, wyes, offsets, adapters, sleeves, caps, plugs), valves, services and structures from two horizontal measurements to permanent surface reference points, and depth below permanent grade. Permanent surface reference points are manholes, catch basins, power poles, and above-grade structures.

b. Ties to all surface structures (including manholes, catch basins, vaults, valve boxes, hydrants, curb stops, cleanouts, wet wells, outlets, etc.) from two horizontal measurements to permanent surface reference points. Re-station surface structures if stationed on Drawings.

c. Ties to other utility crossings, abandoned pipelines, and sewer service stubs, from two horizontal measurements to permanent surface reference

points include depth below permanent grade and spacing between crossing utilities.

d. Invert and rim elevation of all gravity pipelines and structures including manholes, catch basins, below-grade structures, wet wells, septic tanks and distribution boxes as appropriate.

e. Depth of ledge at changes in profile but not more than 25-foot intervals.

f. Changes to pipe size and materials.

2. Locate all utilities and appurtenances concealed in construction. Provide detail not shown on Contract Documents. Use colored pencils or felt tipped pens to record all revisions to the as-built drawings. Use the following color code unless otherwise approved by the Engineer:

a. Process and Mechanical: Red

b. Architectural: Blue

c. Structural: Purple

d. Plumbing: Brown

e. HVAC: Green

f. Electrical: Orange

g. Other: Black

B. Operation and Maintenance manuals – Submit four copies of Operation and Maintenance Manuals for items listed in other sections of these Specifications and for other items when directed by the Engineer. Draft O&M Manuals shall be submitted at least 60 days prior to start up of the equipment through Procore. Copies of the draft manual shall be available for training. Final, tabulated copies of the O&M Manuals shall include the site reports and training documentation.

1. Manuals shall be in three-ring binders. However, manuals which consist of 20 or fewer pages may be bound using three-hole, plastic, clear-front report covers.

2. Manuals shall include, as a minimum:

a. The Operations and Maintenance Manual Certification Form (copy attached at the end of this Section) which shall be attached to every copy of each Operations and Maintenance Manual submitted.

b. A comprehensive index broken down into sections and sub-sections

c. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data

d. Full specifications on each item

e. Detailed service, maintenance and operation instructions for each item supplied

f. System schematic drawings “as Constructed,” illustrating all components, piping and electrical connections of the systems supplied under Division 16

g. Clearly defined special maintenance requirements particular to this system, along with special calibration and test procedures

h. Operating instructions with a functional description of the entire system, with references to the systems schematic drawings and instructions

i. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier

j. A complete "As Constructed" set of approved shop drawings

k. The format of the O&M manual shall meet the following general requirements:

1) Complete, comprehensive index

2) Section with operating instructions including complete overview of the system

3) Section with a complete parts list as described above

4) Section that includes all schematic diagrams, wiring diagrams etc. of the "As Constructed System"

5) Product information

l. Section and sub-section dividers

m. Separate divider for each product

n. Data sheets indicating the tag names (as used on the Drawings), manufacturer, complete model number, complete specifications, and parameter setup sheet with the parameter setup sheets following the manufacturers O&M manual in its entirety

o. Final documentation written specifically for this project including standard and modified standard documentation, with modifications to existing hardware or software manuals made on the respective pages or inserted adjacent to the modified pages. All standard documentation furnished shall have all portions that apply clearly indicated, and all portions that do not apply shall be lined out.

p. All illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment, with illustrated parts numbered for identification and all information applying specifically to the equipment furnished and only including instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

C. Final Documentation – Submit the following final documentation:

1. As-Built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system.

2. The maintenance documentation shall describe the detailed preventative and corrective procedures required to keep the system in good operating condition. All hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary timing diagrams shall be

included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The hardware maintenance documentation shall include, as a minimum, the following information:

a. Operation information – This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.

b. Preventative-maintenance instructions – These instructions shall include all applicable visual examinations, hardware testing and diagnostics routines, and the adjustments necessary for periodic preventative maintenance of the system.

c. Corrective-maintenance instructions – These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.

d. Parts information – This information shall include the identification of each replaceable or field-repairable module. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross-references between the Contractor's part number and manufacturer's part numbers shall be provided. All PC boards shall be identified by; manufacturer and model number, slot number, part name and configuration (if applicable).

D. Provide warranties and bonds for items so listed in pertinent sections of the Project Manual. Provide all warranties and bonds in a three-ring binder.

E. Provide keys and keying schedule, where applicable.

F. Provide evidence of compliance with requirements of governmental agencies having jurisdiction including:

1. Certificates of Inspection.

2. Certificates of Occupancy.

G. As specified in Article 15.06.A of Section 00700, provide evidence that all Work, materials and equipment will pass to Owner free and clear of any Liens or other title defects upon final payment. Such evidence may take the form of receipts or releases from all Subcontractors and Suppliers and an affidavit from Contractor as to the completeness of the receipts and releases as described in Section 00700 Article 15.06.A.3.

H. Provide list of Subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

I. Equipment start-up reports shall be submitted in duplicate to the Engineer for each piece of equipment installed. The report shall include detailed descriptions of the points inspected, tests, and adjustments made, quantitative results obtained and maintenance suggestions. The report shall certify that the equipment (1) has been satisfactorily

installed and conforms to the Contract requirements; (2) is in accurate alignment and free from undue stress; (3) has been operated under full load and operates satisfactorily; and (4) nothing in the installation will render the manufacturer's warranty null and void. Equipment start-up reports shall be included in the appropriate equipment O&M manuals.

J. Provide records of all Owner training/instruction sessions conducted in accordance with paragraph 1.5 of this Section and as required in the project Specifications. The record for each training session shall include reference to the relevant specification section, a summary of the topics covered in the training session, and a sign-in sheet listing all attendees in attendance for the training.

K. Provide color charts, legends, instructions, special tools and other requirements specifically requested in sections of the Specification.

1.5 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide instruction by qualified manufacturers' representatives in the proper operation, maintenance, adjustment and the safety aspects of the equipment and materials furnished. Specific instruction requirements may be included within the sections of the Specification.

1.6 FINAL CLEANING & REPAIRS

A. Complete cleaning prior to final inspection. Cleaning shall include all interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces. Thoroughly wipe clean all ductwork, piping, equipment, devices, and exposed surfaces. Clean debris from lawns, roofs, downspouts and gutters. Sweep paved surfaces and rake lawns and landscaped areas.

B. Use only cleaning materials that will not create hazards to health or property.

C. Remove and entirely dispose of material or debris that has washed, flowed or has been placed in existing watercourses, ditches, gutters, drains, pipe, or structures, for work done under the Contract work limits. Leave ditches, channels, drains, pipes, structures, and watercourses in a clean and neat condition upon completion of the Work.

D. On or before the completion of the Work, tear down and remove all temporary buildings and structures, remove all temporary works, tools, and machinery or other construction equipment, remove all rubbish from any grounds which has been occupied and leave the roads and all parts of the premises and adjacent property in a neat and satisfactory condition.

E. Restore or replace any public or private property damaged or removed during the course of the Work. Property shall be returned to a condition at least equal to that existing immediately prior to the beginning of operations. Complete all highway or driveway, walk, and landscaping work using suitable materials, equipment and methods. Perform restoration of existing property, signs or structures promptly as work progresses; do not leave restoration work until the end of the Contract Time.

1.7 COMPLETION

A. The Contract shall be considered complete and final payment made, only when:

1. All provisions of the Contract Documents have been strictly adhered to.

2. All damage to adjoining areas caused by the Work has been repaired.

3. The project and premises have been left in good order, including removal of all temporary construction, Contractor-owned and extraneous materials as required.

4. All warranties, Operation and Maintenance Manuals, maintenance instructions, releases, and permits called for in the Contract have been submitted to the Owner and Engineer as applicable.

5. All as-built drawings as required by the Contract Documents have been submitted to the Owner.

6. All monies owed the Owner for services performed for the Contractor by Owner's forces in connection with the Contract have been paid.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CLEANING

A. Remove and entirely dispose of material or debris that has washed, flowed or has been placed in existing watercourses, ditches, gutters, drains, pipe, or structures, for work done under the Contract work limits. Leave ditches, channels, drains, pipes, structures, and watercourses in a clean and neat condition upon completion of the Work.

B. Restore or replace any public or private property damaged or removed during the course of the Work. Property shall be returned to a condition at least equal to that existing immediately prior to the beginning of operations. Complete all highway or driveway, walk, and landscaping work using suitable materials, equipment and methods. Perform restoration of existing property, signs or structures promptly as work progresses; do not leave restoration work until the end of the Contract Time.

END OF SECTION

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SECTION 02110

CONTAMINATED SOIL EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Excavation, handling, stockpiling, and temporary storage of Contaminated Soil and/or Polluted Soil.

2. Refer to Drawing C-108, for the location of areas containing potentially Contaminated Soils and/or Polluted Soils.

3. Movement and placement of Contaminated Soil and Polluted Soil into a temporary controlled stockpile area.

4. Segregation and stockpiling of materials for characterization sampling by the Owner/Engineer.

5. Decontamination of tools, equipment, and vehicles and the collection, management and disposal of resulting liquids and/or solids.

6. Other work involving the handling of Contaminated Materials which may be required includes, but is not limited to, miscellaneous facility component removal, removal of obstructions, excavation support systems, and any incidental work related thereto.

B. Related Sections

1. Section 01350 - Health & Safety Plan

2. Section 02120 - Transportation and Disposal of Contaminated Materials

3. Section 02315 - Excavation, Backfill, Compaction and Dewatering

1.2 REFERENCES

A. Regulations of Connecticut State Agencies (R.C.S.A) Sections 22a-133k-1 though 22a-133k-3

B. 40 CFR Part 261, Identification and Listing of Hazardous Waste

C. 40 CFR Part 268, Land Disposal Restrictions

D. Documents referenced in the Related Sections listed above.

1.3 DEFINITIONS

A. Contaminated Soil: Means treated or untreated soil and/or sediment affected by a known or suspected release and determined, or reasonably expected to contain substances exceeding Residential Direct Exposure Criteria or GA Pollutant Mobility Criteria, as these terms are defined in section 22a-133k-1 of the Regulations of Connecticut State Agencies.

B. Polluted Soil: Means soil affected by a release of a substance at a concentration above the analytical detection limit for such substance.

C. Contaminated Material: Includes Contaminated Soil, Polluted Soil, decontamination wastes, and any other regulated wastes generated during construction.

D. Clean Fill: Means (1) natural soil and (2) rock, ceramics, uncontaminated brick, and concrete.

E. Natural Soils: Soils not known or suspected to be Contaminated or Polluted.

F. Special Handling: Methods used to excavate, collect, grade, load, move, transport, stockpile, dispose, or otherwise manage a contaminated material or Contaminated Soil are such that (1) the spillage, loss, co-mingling, or uncontrolled deposition of such material is minimized, (2) personal exposure to contaminants present in such a material are minimized, (3) the adverse impacts to the community and the surrounding environment from contaminants present in such material are minimized, (4) all applicable regulatory requirements applicable to such activity are satisfied.

1.4 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 requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

B. All Contaminated Soil and Polluted Soil excavated or otherwise collected, consolidated, and managed during the course of the work will require Special Handling in accordance with these specifications, Contractor Health and Safety Plan, and all applicable permits, approvals, authorizations, and Regulations.

C. Perform the handling of Contaminated Materials with equipment and techniques in accordance with the performance requirements defined in this specification.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Provide all employees and subcontractor(s) with personal protective equipment and protective clothing consistent with the levels of protection for this work as indicated in Contractor's Health and Safety Plan.

B. Perform all contaminated material handling operations in accordance with standard engineering practices applicable to such activity, according to CTDEEP regulations, and according to the provisions of Contractor Health and Safety Plan. Utilize methods which consider the health and safety of all Contractor and subcontractor personnel, support personnel, Engineer and his representatives, and the surrounding environment.

C. All site health and safety controls shall be fully established and in operation prior to beginning any contaminated material handling activity. Site controls shall include but not be limited to work zones properly barricaded, and all support equipment and supplies including personal protective equipment. Comply with the requirements of Section 01350, Health and Safety Plan.

D. Minimize the spread of Contaminated Materials during handling. Transport vehicles used to move Contaminated or Polluted Soil at the Project Site shall be free from leaks. Trucks or other conveyances deemed unacceptable for use by Engineer shall not be used for the movement of Contaminated Materials.

E. Keep work areas, including but not limited to, areas adjacent to excavations, roadways leading to and from excavation areas, driveways, parking areas, and public roadways free of Contaminated Materials. If such materials are deposited, spilled, or spread, such material shall be removed promptly, and properly disposed of to the satisfaction of Engineer no later than the end of each working day or as requested by Engineer.

F. Owner is the generator and will sign all manifests and bills of lading. Except for materials required to be transported under manifest, transport all Contaminated Soil material under bills of lading (prepared by Engineer) regardless of the chemical quality of the soils.

3.2 EXCAVATION OF CONTAMINATED MATERIALS

A. Perform excavation in accordance with the requirements of Section 02315, Excavation, Backfill, Compaction and Dewatering, and this section.

B. Excavate Contaminated Soil and Polluted Soil from zero feet to two feet in depth across the site to the horizontal and vertical limits required for completion of the Work.

C. Engineer will periodically observe field conditions. This observation may require Engineer to work in close proximity to Contractor's excavation equipment, and may require frequent pauses in the work. Contractor shall work in a cooperative manner at all times during these operations to ensure the safety of Engineer, and to allow for thorough field evaluations to be conducted.

1. When contaminated material excavation is undertaken, Engineer may adjust the limits of excavation required to achieve remediation objectives based on field observations. Such limits may be greater than or less than the limits identified in 3.2B and shall be based upon actual conditions encountered at the time of excavation.

2. If required, Engineer will define those areas beyond the limits originally indicated where additional contaminated material excavation shall be required based upon field observations.

D. Minimize the spread and loss of Contaminated Materials during excavation activities.

1. Following excavation, transport Contaminated Materials directly to the temporary controlled stockpile area for stockpiling. Excavated Contaminated Materials shall not be placed directly on the ground.

E. Employ methods necessary to isolate Contaminated Materials from non-contaminated soils to the degree practicable.

F. Segregate construction debris from excavated Contaminated Materials at the point of excavation, prior to the movement of Contaminated Materials from excavation areas. Engineer may evaluate debris during excavation to determine if such material can be designated uncontaminated general demolition material.

G. Employ methods necessary to isolate Contaminated Materials from Natural Soils to the degree practicable.

H. Implement measures to divert surface water around excavation sites to prevent water from directly entering into open excavations.

3.3 BACKFILL

A. Backfill excavations in accordance with Section 02315, Excavation, Backfill & Compaction and Dewatering.

3.4 ON-SITE MANAGEMENT AND REUSE OF POLLUTED, CONTAMINATED, AND NATURAL SOILS

A. Polluted Soils and/or Contaminated Soils are known to be located within the top two feet of the project area. Soil from these areas that are disturbed may be reused on-site as follows.

1. Contaminated and Polluted Soils can be reused beneath areas that will be paved, beneath new building slabs, or beneath other structures so long as they meet the geotechnical requirements required for this project.

2. Contaminated and Polluted Soils can be reused in on-site landscaped areas with the following restrictions:

a. Polluted or Contaminated soil cannot be placed below the water table.

b. Polluted or Contaminated soil cannot be placed in an area subject to erosion.

c. A map showing the location and depth of all re-used Polluted and Contaminated soil must be prepared by the Contractor following the completion of site work.

B. Polluted Soils or Contaminated Soils may also be disposed of at an approved off-site facility licensed to accept the material. Engineer will collect waste characterization samples for disposal in accordance with Section 02120.

C. Materials anticipated to be Natural Soils may be re-used on-site without environmentally related restrictions. Excess materials anticipated to be Natural Soils must be sampled and analyzed for contaminants of concern identified at the site or required by the receiving party prior to off-site re-use or disposal. If materials tested are determined to be polluted or contaminated, they must be managed as such in accordance with this Section. Engineer will conduct sampling and analysis for soil characterization required for off-site reuse or disposal.

1. Contractor is hereby notified that laboratory turnaround time for the analysis of characterization samples may be up to 7-10 working days from date of collection. No claim for delay will be considered based upon Contractor failing to accommodate the laboratory turnaround time as defined herein.

D. Soils proposed for on-site reuse must also meet all other reuse requirements included in the Contract Documents including, but not limited, to geotechnical requirements.

3.5 UNFORESEEN CONTAMINATED MATERIALS

A. In the event that unforeseen Contaminated Materials are encountered during the course of the work, permit the Engineer sufficient time to devise an appropriate course of action based upon the conditions present.

1. Until such appropriate course of action is devised, Contractor shall secure the work area in question such that it does not pose a health and safety risk.

2. Engineer will provide Contractor with a scope of work and performance requirements for the collection, consolidation, removal or excavation of unforeseen contaminated material. Contractor shall then undertake contaminated material remediation with equipment and techniques established by Contractor in accordance with said scope of work and performance requirements.

B. Contaminated material remediation shall be performed in accordance with scope of work outlined in Item 3.4 and in accordance with this specification.

3.6 STORAGE OF EXCAVATED MATERIALS

A. Excavated Contaminated and/or Polluted material shall be temporarily stockpiled at a location within the pump station temporary easement. Stockpile Contaminated and/or Polluted soils in such a manner to protect existing site surface, materials and structures from contamination, runoff and erosion. Place the Contaminated and/or Polluted soil on a minimum of 6 mil polyethylene sheeting and at the end of each day the stockpiled soil shall be covered with 6 mil polyethylene sheeting and secure the covering to prevent the stockpile from becoming uncovered due to winds.

B. Excavate, segregate, and stockpile excess materials anticipated to be Natural Soils in such a manner to protect existing site surface materials and structures from runoff, erosion, and mixing with Contaminated and/or Polluted Soils.

3.7 DUST CONTROL

A. Implement fugitive dust suppression to prevent unacceptable levels of dust resulting from handling operations associated with Contaminated Materials. Dust suppression methods shall be subject to approval from Engineer. Supervise fugitive dust control measures and monitor airborne particulate matter as required.

END OF SECTION

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SECTION 02120

TRANSPORTATION AND DISPOSAL OF CONTAMINATED SOIL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Transportation and disposal of Contaminated Soil or materials collected, consolidated, excavated, and generated during performance of the Work.
2. Coordination, loading, transportation and disposal of contaminated materials.
3. Contaminated Materials to be disposed of include, but may not be limited to:
   a. Contaminated Soils and excess Polluted Soils as defined in Section 02110.
   b. Waste residuals from Contractor's stockpiling and decontamination operations.

B. Related Sections

1. Section 01350, Health & Safety Plan
2. Section 02110, Contaminated Soil Excavation
3. Section 02315, Excavation, Backfill, Compaction and Dewatering

C. All Contaminated Materials consolidated or otherwise managed during the course of the work will require Special Handling in accordance with these specifications, the Contractor's Health and Safety Plan, and all applicable permits, approvals, authorizations, and Regulations.

D. The disposal of Contaminated Materials will occur at facilities proposed by Contractor and approved by Owner.

E. Contractor shall coordinate work between all Subcontractors, sections, and trades required for the proper completion of the work.

F. Contractor is responsible for the health and safety of all Subcontractor workers during progress of the work.

1.2 DEFINITIONS

A. Contaminated Material: Includes Contaminated Soil, Polluted Soil, decontamination wastes, and any other regulated wastes generated during construction.

B. Disposal: The discharge, deposit, injection, dumping, spilling, leaking, incineration or placing of any contaminated material or otherwise hazardous substance into or on any land or water so that such hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

C. Generator: Any person, by site, whose act or process produces hazardous waste, or whose act first causes an oil or hazardous material to become subject to regulation.

D. Regulated Waste: Non-Resource Conservation and Recovery Act (RCRA) hazardous wastes such as oils, petroleum products or residuals, chemical liquids, chemical gases or vapors, non-Toxic Substances Control Act (TSCA) polychlorinated biphenyls (PCBs),

waste chemical solids, including soils, and other contaminated material wastes not defined as RCRA Hazardous, TSCA-regulated, or Special Waste.

E. Manifest: An approved form used as a shipping document to identify the quantity, composition, and the origin, routing, and destination of regulated or hazardous waste from the site of generation to the point of disposal, treatment, storage, or use.

F. Shipping Paper: An invoice, bill of lading, or other shipping document serving a similar purpose; other than a hazardous waste manifest used to document the conveyance of materials between different locations, including regulated wastes when applicable.

G. Treatment: Any method, technique or process, including neutralization, incineration, stabilization or solidification, designed to change the physical, chemical or biological character or composition of any hazardous waste so as to neutralize such waste or so as to render such waste less hazardous, non-hazardous, safer to transport, amenable to storage, or reduced in volume, except such method or technique as may be included as an integral part of a manufacturing process at the point of generation.

H. Non-RCRA Out-of-State Lined Landfill: This type of landfill shall be state approved or permitted to accept material that is defined as a hazardous material in CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations, but is not classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261; material containing PCBs below 50 ppm; and all other material not permitted or unsuitable for in state disposal or recycling.

I. Out-of-State Recycling Facility: This type of facility shall be state approved or permitted to accept material that is defined as a hazardous material in CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations, but is not classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261; material containing PCBs below the facility's permitted level; and all other material not permitted or unsuitable for in state disposal or recycling. In-State Recycling Facility: This type of facility shall be approved by the State of Connecticut to accept material that is classified as petroleum contaminated material that would be classified as a hazardous material in CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations if not managed under CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations; and is not classified as a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261.

J. In-State Landfill Facility (Reuse as Cover Material): This type of facility shall be approved by the State in which the landfill is located to accept material that is classified as polluted material, that would be classified as a hazardous material in CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations if not managed under CGS Section 22a-114 to 22a-134z Hazardous Waste Regulations; and is not classified as a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261.

1.3 SUBMITTALS

A. Submit all pertinent information relating to the transport and disposal of materials specified herein, within 14 days after issuance of the Notice to Proceed and prior to transport and disposal. The information submitted be in one package and shall include the following, as a minimum:

1. Information for proposed treatment/disposal facility or facilities including the following:

a. General Information

1) Facility Name
2) Facility Address
3) Name of Contact Person
4) Title of Contact Person
5) Telephone Number of Contact Person
6) Permit Number

b. The facility shall specify the volume of material that can be accepted from the Project on a weekly and a total basis.

c. The facility shall provide written confirmation that they are permitted to accept and will accept the classified contaminated materials the general quality and quantity described by these specifications.

d. The facility shall provide a listing of all current and valid permits, licenses, letters of approval, and other authorizations to operate that they hold, pertaining to the receipt and treatment/disposal of the contaminated materials described by these specifications.

2. Submit a complete list of the disposal facility's permitted allowable contaminant levels and physical characteristics requirements for contaminated material and list any required regulatory approvals and analytical testing requirements for individual waste streams.

B. Submit in writing to Engineer name of the transportation company or companies which Contractor proposes to utilize to transport Contaminated Materials from the Project. For each transporter identified, include the following information:

1. Name and address of all Contaminated Material transporters to be used to complete Project.

2. State of Connecticut Transporter Identification Number and expiration date, if applicable.

3. Proof of permit, license, or authorization to transport Contaminated Materials in all affected states.

C. Upon receipt of final approval from treatment/disposal facility to accept contaminated materials, submit copy of said approval.

D. Within ten (10) working days after the off-site transportation of contaminated materials, submit copies of all paperwork related to transportation of contaminated materials. Such paperwork may include, but not be limited to receipts, weight tickets, and disposal certificates.

1. Provide certified tare and gross weight slips for each load received at the designated treatment/disposal facility which shall be attached to copy of related manifest or bill of lading.

E. Prior to receiving progress payment, submit documentation certifying that all materials were transported to, accepted, and disposed of, at the selected treatment/disposal facility. The documentation shall include the following, as a minimum.

1. Documentation for each load from the site to the disposal facility, including all manifests and any other applicable transfer documentation.

2. All documentation for each load shall be tracked by the original manifest or bill of lading document number assigned at the project site at time of signature by authorized Engineer.

1.4 REGULATORY REQUIREMENTS

A. Obtain all Federal, State and local permits, approvals, or authorizations required for the transport and disposal of contaminated materials. Adhere to all requirements of such permits, approvals, or authorizations.

PART 2 PRODUCTS

2.1 GENERAL

A. All Contractor's personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection for this work as indicated in Contractor's Site Health and Safety Plan.

B. Contractor shall select treatment/disposal facilities to receive Contaminated Materials from the Project which are established, fully operational, and in full compliance with all applicable Federal, State, and local regulations.

PART 3 EXECUTION

3.1 GENERAL

A. All Contaminated Materials shall be removed from the Project Site and legally recycled or disposed of by Contractor.

B. Contaminated materials to be disposed of include, but are not limited to contaminated soil, rock, miscellaneous contaminated debris, and other materials from THE remediation and decontamination operations.

C. All contaminated materials excavated, consolidated, or otherwise managed during the course of the work will require special handling in accordance with these specifications, the Contractor's Health and Safety Plan, and all applicable permits, approvals, authorizations, and regulations.

D. Dispose of contaminated materials at facilities approved by Owner and Engineer.

E. All Contractor personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection for this Work as indicated in the Site Health and Safety Plan.

F. Contractor shall select treatment/disposal facilities to receive contaminated materials from the Project which are established, fully operational, and in full compliance with all applicable Federal, State, and local regulations.

G. Perform collection of characterization (except soils) samples and laboratory analyses to satisfy the acceptance criteria for selected receiving facility(s).

H. Remove all contaminated materials from the project site and legally dispose of materials.

3.2 CHARACTERIZATION FOR DISPOSAL-CONTAMINATED SOIL

A. Contaminated soil characterization sampling will be conducted by the Engineer.

B. The Engineer will collect soil samples. Such samples may be collected from within Excavation Areas or following deposition of Contaminated Soil in the Temporary Controlled Stockpile Area.

1. Contractor is responsible for any in-situ sample collection costs associated with test pitting, drilling, or other means of collecting the necessary samples.
2. Contractor is responsible for all laboratory charges associated with samples collected by the Engineer.
3. Contractor must provide Engineer with a complete list of analytical parameters required by the selected disposal or re-use site prior to requesting that samples be collected.

3.3 DISPOSAL COORDINATION AND TRANSPORT

A. Contractor is solely responsible for coordinating treatment/disposal facility approval, scheduling, loading, transport, and ultimate disposal of contaminated materials at treatment/disposal facility. No claim for delay will be considered based upon Contractor's facility failing to meet Contractor's production schedule. No payments will be made for rejected loads.

3.4 MANIFESTS AND SHIPPING PAPERS

A. Owner is designated as the "Generator" and will sign all Manifests and Shipping Papers. Manifests and Shipping Papers shall be prepared by Contractor twenty four (24) hours in advance of shipment of contaminated materials. Authorized Owner's representative will sign as "Generator" as each load of contaminated material leaves the Project Site. Contractor shall forward appropriate original copies of Manifests or Bills of Lading to Engineer on the same day the contaminated materials leave the Project Site.

3.5 TRANSPORT OF CONTAMINATED MATERIAL

A. Transport contaminated materials off-site after all treatment/disposal facility documentation has been completed and the material accepted by said facility.

B. Transport Contaminated Materials from the site to treatment/disposal facility in accordance with all United States Department of Transportation (DOT), USEPA, Connecticut regulations and other regulations of all affected states. The Hauler(s) shall be licensed in all states affected by transport.

C. Provide to Engineer copies of all weight slips, both tare and gross, for every load weighed and disposed of at the accepted disposal facility. The slips shall be tracked by the original manifest document number that was assigned by Engineer at the site. Owner will only make progress payments upon receipt of these weight slips.

D. Minimize the potential for development of free liquid during transport. Do not load wet soils for transport. If free liquid does develop during transport, Contractor shall be responsible for proper collection and disposal of same.

E. If necessary, soil located in the Temporary Stockpile Area shall be removed from the Project Site in accordance with the requirements of this section.

END OF SECTION

SECTION 02200

SITE PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes

1. Clearing and grubbing

2. Grading

3. Stripping and stockpiling of soil and sod

1.2 SUBMITTALS

A. Submit construction methods and equipment that will be utilized for the clearing, grubbing, and waste material disposal specified within this Section.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

A. Except as otherwise directed, cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits of the Work on the site and where required to construct the work.

B. Protect trees or groups of trees, designated by the Engineer to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Conduct clearing operations to prevent falling trees from damaging trees designated to remain.

1. All damage done to the trees by the Contractor's operation shall be trimmed and painted where cut as directed or as necessary to provide adequate vertical clearance for construction activities. The dressing or paint shall be applied no later than two days after the cuts are made.

2. Use all necessary precautions to prevent injury to other desirable growth in all areas. Contractor shall assume full responsibility for any damage.

C. Protect areas outside the limits of clearing from damage. No equipment or materials shall be stored in these areas.

D. No stumps, trees, limbs, or brush shall be buried in fills or embankments.

3.2 DISPOSAL OF MATERIALS

A. Remove all tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material from the site and dispose of in a legal manner.

B. Burning or direct burial of cleared and grubbed materials on-site will not be permitted.

3.3 GRADING

A. In preparation for placing loam, paved drives and appurtenances, perform grading to the lines, grades and elevations shown on the Drawings, and otherwise directed by the Engineer and perform in such a manner that the requirements for formation of embankments can be followed. All material encountered, regardless of its nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, maintain the subgrade in such condition that it will be well drained at all times. Install temporary drains and drainage ditches to intercept or divert surface water that may affect the work when necessary.

B. If at the time of grading it is not possible to place material in its final location, stockpile material in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.

C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses.

D. Stones or rock fragments larger than 4 inches in their greatest dimensions will not be permitted in the top 12 inches of the finished subgrade of all fills or embankments except along the access roadways and rip-rap where shown on the Drawings.

E. In cuts, loose or protruding rocks on the excavated slopes shall be barred loose or otherwise removed to line or finished grade of slope. Cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as directed by the Engineer.

3.4 DUTCH ELM WOOD

A. Dutch Elm diseased wood shall be disposed of in accordance with any local regulations.

B. Where the work includes the removal of elm trees or the limbs of elm trees, such trees or limbs thereof shall be disposed of immediately after cutting or removal and in such a manner as to prevent the spread of Dutch Elm disease. This shall be accomplished by covering them with earth to a depth of at least 6 inches in areas outside the right-of-way locations where the Contractor has arranged for disposal.

C. Where the work includes the removal and disposal of stumps of elm trees, such stumps shall be completely disposed of immediately after cutting in the manner specified above.

END OF SECTION

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SECTION 02210

SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Soils subsurface investigation at the site, the use of data resulting from the investigation, and conditions warranting additional soils investigation.

2. Pipe and utility subsurface investigations that are required to properly locate, plan for and/or connect to the various existing pipelines.

B. Related Sections

1. Section 00300 – Geotechnical Data

2. Section 02920 - Lawns and Grasses

3. Section 02315 - Excavation, Backfill, Compaction, and Dewatering

4. Section 02740 - Bituminous Concrete Pavement

1.2 REFERENCES

A. 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.560 through 1926.562 including Appendices A through F

1.3 QUALITY ASSURANCE

A. The entire test pit excavation and collection of utility information must be observed by the Engineer.

1.4 SITE CONDITIONS

A. Soils Investigation

1. Copies of the exploration logs are included in Section 00300. Exploration locations are shown on the Drawings.

2. Use of the Data: The Drawings indicate conditions as they are believed to exist based upon limited subsurface explorations. Investigations and field tests must be conducted to verify the conditions that exist which may affect the Work. All investigations must be conducted under the Engineer's observation.

B. Pipeline and Utility Investigations: The Drawings show available data relative to existing underground pipe and utilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Obtain all available information on buried structures and utilities in the vicinity of the investigation.

B. Coordinate Work such that all affected property, structure, and utility owners are aware of the Work prior to its commencement. Schedule subsurface investigations such that they do not interfere with other Work or traffic and in advance of other Work in that location.

C. Provide the Engineer with 24-hour notice prior to commencement of subsurface investigations.

3.2 SUBSURFACE INVESTIGATIONS

A. Prior to exploration operations, delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on non-paved surfaces and coordinate with the appropriate agencies (e.g. Call Before You Dig) in accordance with State regulations. Pre-marking will not be acceptable if such marks can interfere with traffic or pedestrian control or are misleading to the general public. Pre-marking will not be required of any continuous excavation that is over 500 feet in length

B. Excavate test pits as indicated, or as requested by the Owner. Expose the top of the pipeline, and adjacent utilities, at each test pit location.

C. Contractor may, at its expense and with permission by the Owner, perform additional explorations not ordered by the Engineer.

D. Perform test pits in accordance with the requirements of Section 02315. Excavate the bottom 2 feet of the test pit (or in close proximity to known or anticipated utilities) by hand. Excavate to top of pipelines by hand. The Test pit work shall be performed to safely excavate and examine the structure or utility to be exposed without damaging existing utilities, including bracing, sheeting and dewatering the excavation, as necessary.

E. Measure the depth to the top of the pipeline, as well as to adjacent utilities, from the ground surface, at each test pit location. Record location, depth and size of pipelines and utilities uncovered during the test pits. Record any other pertinent information which is learned as a result of excavating the test pit.

F. Excavate test pits of an appropriate size with equipment suitable for the location and character of the pit to be excavated. All subsurface investigations shall be conducted in accordance 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.650 through 1926.652 including Appendices A through F.

G. After observation by the Engineer, backfill and compact the test pits in accordance with Section 02315. Borings or other drilled probes shall be filled in their entirety with grout upon completion.

H. Repair damage to any structure, utility, or site feature on private or public property damaged during the Work to the satisfaction of the Engineer.

I. Repair paved surfaces in accordance with Section 02740.

J. Repair lawn areas or grass surfaces in accordance with 02920.

END OF SECTION

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SECTION 02315

EXCAVATION, BACKFILL, COMPACTION AND DEWATERING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Excavation, backfill and compaction for buildings, retaining walls and other structures (i.e., wet well and valve vault)

2. Excavation, backfill and compaction for subsurface utilities and below-grade structures

3. Removal, handling and disposal of rock

4. Earth retention systems

5. Temporary dewatering systems

B. Related Sections

1. Section 01570 - Temporary Controls

2. Section 02110 – Contaminated Soil Excavation

3. Section 02120 - Transportation and Disposal of Contaminated Material

4. Section 02210 - Subsurface Investigations

5. Section 02320 - Borrow Materials

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

F. Connecticut Department of Transportation (CTDOT) Standard Specifications for Roads, Bridges, and Incidental Construction, 'Form 818', latest revision.

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 where the work is to be performed. 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 where the work is performed.

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 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 02320, 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. The Contractor shall plan his operations to allow adequate time for laboratory tests and to permit taking of field density tests during compaction.

1. Methods and equipment proposed for compaction shall be subject to prior review by the Engineer. Compaction generally shall be done with vibrating equipment. Static rolling without vibration may be required by the Engineer on sensitive soils that become unstable under vibration. Displacement of, or damage to existing utilities or structure shall be avoided. Any utility or structure damaged thereby shall be replaced or repaired as directed by the Engineer.

2. Additional compaction testing may be required when there is evidence of a change in the quality of moisture control or the effectiveness of compaction.

a. Any costs associated with correcting and retesting as a result of a failure to meet compaction requirements shall be borne by the Contractor.

3. 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.

4. 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.

F. Dewatering plan for the excavation locations. Design shall include calculations and drawings stamped and signed by a Professional Engineer registered in the state where the work is performed.

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. Employ the services of a dewatering specialist or firm when well points, deep wells, recharge systems, or equal systems are required. Specialist shall have completed at least 5 successful dewatering projects of equal size and complexity and with equal systems.

1.6 PROJECT CONDITIONS

A. Notify "Call Before You Dig" and obtain e-ticket identification number.

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 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. For this project, the permit should be obtained from the Town of Plainville.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. Fill material is subject to the approval of the Engineer 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. Additional requirements are included in Section 02320.

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.

E. 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 01570.

B. Provide silt filter bags (Dandy Dewatering Bag, Dirtbag, JMP Environ-Protection Filter Bag, or equal) of adequate size to match flow rate.

C. Provide dewatering equipment and materials for engineered dewatering systems.

PART 3 EXECUTION

3.1 PREPARATION

A. Public Safety and Convenience

1. Adhere to the requirements of the latest revision of the CTDOT Standard Specifications for Roads, Bridges, and Incidental Construction, 'Form 818', 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 and Engineer at site during construction.

4. Do not obstruct site drainage, natural watercourses or other provisions made for drainage.

3.2 TEST PITS

A. Prior to test pitting operations, delineate the general scope of the excavation or boring on the paved surface of the ground using white paint, or stakes or other suitable white markings on non-paved surfaces and coordinate with the appropriate agencies in accordance MGL Chapter 82 Section 40. Pre-marking will not be acceptable if such marks can interfere with traffic or pedestrian control or are misleading to the general public. Pre-marking will not be required of any continuous excavation that is over 500 feet in length

B. Excavate test pits as required to verify location of existing utilities when approved by Owner, or as requested by the Owner. Expose the top of the adjacent utilities, at each test pit location.

C. Contractor may, at its expense and with permission by the Owner, perform additional explorations not ordered by the Engineer.

D. Perform test pits in accordance with the requirements of this section Excavate the bottom 2 feet of the test pit (or in close proximity to known or anticipated utilities) by hand. Excavate to top of pipelines by hand. The Test pit work shall be performed to safely excavate and examine the structure or utility to be exposed without damaging existing utilities, including bracing, sheeting and dewatering the excavation, as necessary.

E. Measure the depth to the top of the pipeline, as well as to adjacent utilities, from the ground surface, at each test pit location. Record location, depth and size of pipelines and utilities uncovered during the test pits. Record any other pertinent information which is learned as a result of excavating the test pit.

F. Excavate test pits of an appropriate size with equipment suitable for the location and character of the pit to be excavated.

G. All subsurface investigations shall be conducted in accordance 29 CFR Part 1926 Subpart P - OSHA Excavation Regulations 1926.650 through 1926.652 including Appendices A through F.

H. After observation by the Engineer, backfill and compact the test pits in accordance with the requirements of this section.

I. Repair damage to any structure, utility, or site feature on private or public property damaged during the Work to the satisfaction of the Engineer.

J. If required by the CTDOT, repair paved surfaces in accordance with Section 02740.

3.3 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. Sheeting

   a. 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.

   b. Drive sheeting ahead of and below the advancing excavation to avoid loss of materials from below and from in front of the sheeting.

   c. 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.

4. Remove earth retention system, 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.

   a. 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.

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. Perform excavation in such a manner as to prevent disturbance of the final subgrade. The Engineer or Owner may require the final six inches of excavation be performed by hand, with the use of a smooth-faced bucket, or other means acceptable to the Engineer or Owner, at no additional cost if subgrade disturbance is considered excessive as judged by the Engineer or Owner.

5. 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 excavation 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.

6. Grade or create berms or swales to direct surface water from excavations to appropriate structures designed to accommodate storm water. If no structures exist, direct water to areas that minimize impacts to adjacent structures and properties.

7. 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.

8. Perform the excavation in such a manner as to prevent disturbance of the final subgrade. If excessive subgrade disturbance is occurring, as judged by the Owner or Engineer, then the final 6 inches of the excavation shall be performed by hand, with the use of a smooth-faced bucket, or other means acceptable to the Engineer or Owner.

   a. Grade the excavation bottom to provide uniform bearing and support for the bottom quadrant of each section of pipe.

   b. Excavate bell holes at each joint to prevent point bearing.

   c. Remove stones greater than 6 inches in any dimension from the bottom of the trench to prevent point bearing.

9. 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 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. Prior to backfilling or placement of structures, excavated subgrades shall be proof compacted with either 10 passes of a 10-ton vibratory drum roller for open excavations or 6 passes of a large, reversible, walk behind vibratory compactor capable of exerting a minimum force of 2,000 pounds in trench or pit excavations. Any subgrades that are soft or yielding under proof compaction efforts, or contain existing fill, should be removed below the footprint of the structures as well as in the footing bearing zone which is defined by a 1H:1V plane extending downward and outward from one foot beyond the edge of footing and replaced with compacted Granular Fill, Gravel Borrow, or compacted Crushed Stone wrapped in a non-woven geotextile, as directed by the Owner or their representative. If proof compaction will prove detrimental to the subgrade due to the presence of groundwater, static rolling may be allowed at the discretion of the Engineer or Owner.

4. Soil bearing surfaces shall be protected against freezing and the elements before and after concrete placement. If construction is performed during freezing weather, structures shall be backfilled as soon as possible after they are constructed. Insulating blankets or other means shall be used for protection against freezing at the discretion of the Engineer or Owner.

5. 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.

    a. Use borrow material if there is no excess of excavated material available at other portions of the Project.

6. Backfilling and compaction methods shall attain 95% of maximum dry density at optimum moisture content as determined in accordance with ASTM D1557.

7. Do not place stone or rock fragment larger than six inches in greatest dimension in the backfill.

8. 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.

9. Do not drop large masses of backfill material into the trench endangering the pipe or adjacent utilities.

10. Install pipe in 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.

11. 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.

12. Electrical conduit not encased in concrete, shall be backfilled with sand borrow conforming to the requirements of Section 02320. The backfill shall be placed in the trench for its full width and shall extend to 12 inches over the conduit.

13. 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. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required to correct the problem, and shall then be refilled and properly compacted with the surface restored to required grade at no additional expense.

14. The Contractor shall not place backfill against or on structures until they have attained sufficient strengths to support the loads to which they will be subjected,

without distortion, cracking, or other damage. As soon as possible after the structures are adequate, they shall be backfilled with suitable backfill material.

15. Place and compact backfill around manholes, vaults, pumping stations, gate boxes or other structures in six-inch layers, from a point one foot over the pipe. Exercise care to protect and prevent damage to the structures.

16. Install impervious trench dams where stone borrow is used for pipe bedding to prevent groundwater from following along the stone bedding. Install dams every 100 feet.

D. Test Pit Excavation

1. General requirements of test pits are specified in Section 02210.

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. Conduct operations so as to prevent at all times the accumulation of water, ice and snow in excavations or in the vicinity of excavated areas so as to prevent water from interfering with the progress or quality of the work.

3. 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.

4. 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.

5. 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.

6. 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.

7. Brace or otherwise protect pipelines and structures not stable against uplift during construction.

8. Do not excavate until the dewatering system is operational and the excavation may proceed without disturbance to the final subgrade.

9. 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.

10. Temporarily lower the groundwater level at least two feet below excavations to limit potential "boils,"loss of fines, or softening of the ground. If any of these conditions are observed, submit a modified dewatering plan to the Engineer within 48 hours. Implement the approved modified plan and repair any damage incurred.

11. When subgrades are soft, weak, or unstable due to improper dewatering techniques, remove and replace the materials in accordance with Section 02320 at no cost to the Owner.

12. 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 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 cost to the Owner.

13. 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 or other approved sedimentation device 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.

14. Install erosion/sedimentation controls for velocity dissipation at point discharges onto non-paved surfaces.

15. 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 02320.

    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.

3.4 PROTECTION

A. Protection of Existing Structures

1. All existing foundations, conduits, wall, pipes, wires, poles, fences, property line markers and other items which the Engineer decides must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the Contractor. Should such items be damaged, they shall be restored by the Contractor to at least as good condition as that in which they were found immediately before the Work began.

B. Accommodation of Traffic

1. Streets and drives shall not be unnecessarily obstructed. The Contractor shall take such measures at his own expense to keep the street or road open and safe for two-way traffic unless otherwise indicated.

2. Construct and maintain such adequate and proper bridges over excavations as may be necessary or as directed for the safe accommodation of pedestrians and vehicles. Provide substantial barricades at crossings of trenches, or along the trench to protect the traveling public.

3. Where deemed necessary, such additional passageways as may be directed shall be maintained free of such obstructions. All material piles, open excavations, equipment, and pipe which may serve as obstructions to traffic shall be protected by proper lights, signage, or guards as necessary.

4. All traffic controls shall be in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition.

C. Erosion and Sedimentation Control

1. Take all necessary steps to prevent soil erosion.

2. Plan the sequence of construction so that only the smallest practical area of land is exposed at any one time during construction.

3. Temporary vegetation and/or mulching shall be used to protect critical areas exposed during construction as judged by the Engineer.

END OF SECTION

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SECTION 02317

UNDERGROUND WARNING TAPE

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 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

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 no more than 24 inches below final grade to allow detection by a metal detector.

END OF SECTION

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SECTION 02320

BORROW MATERIALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Gravel Borrow
2. Processed Gravel Borrow for Pavement Subbase
3. Granular Fill
4. Stone Borrow

B. Related Sections

1. Section 02315 – Excavation, Backfill, Compaction and Dewatering

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./ft3)

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 818', 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. 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.

1. Take and test a sample of low permeability soil for each 5,000 cy of material placed, or as directed by the Engineer.

2. All other borrow materials shall be tested once unless more frequent testing is deemed necessary by the Engineer or Owner due to material variation.

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 Engineer.

B. A Certificate of Clean Fill must be provided to Engineer and Owner for approval prior to delivery of any and all fill material including but not limited to mineral soil, borrow material, structural fill, processed fill material, loam, or topsoil to be placed on site during the course of the Work. The Certificate must include laboratory analytical reports for all material to be used at the site on a basis of one sample per every 500 cubic yards or lesser portions thereof. Analytical reports must demonstrate that the proposed material does not contain detectable concentrations of contaminants including but not limited to; petroleum hydrocarbons, semi volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), pesticides, and/or herbicides and that metals listed in the Connecticut Remediation Standard Regulations do not exceed minimal concentrations deemed allowable by Engineer and Owner. No fill material shall be placed on site until Contractor has received approval from Engineer and/or Owner. Engineer and Owner reserve the right to collect and analyze samples from any proposed fill material prior to or after delivery to the site and to allow use of off-specification material at their sole discretion.

The Certificate must clearly state the following and be signed by and authorized signatory employed by the Contractor:

1. Volume of material to be used.
2. Process by which the material was obtained.
3. Location of origin and summary of current and past site uses of the location of origin.
4. Statement from Contractor that the analytical reports included with the Certificate represent the specific material to be used at the site.
5. Statement that Contractor does not know or have reason to believe that the proposed fill material contains foreign materials or contaminants.

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 GRAVEL SUBBASE

A. Gravel subbase shall conform to the requirements of M.02.02 of Form 818 Standard Specifications.

2.2 PROCESSED AGGREGATE

A. Processed aggregate for use as a road pavement base shall conform to the requirements of Article M.05.01 of the Form 818 Standard Specifications.

2.3 STONE BORROW

A. Foundation stone for normal pipe bedding shall be graded, crushed, broken or processed stone, conforming to the grading requirements for 3/8 inch or 3/4 inch stone of Article M.01.01 of the Form 818 Standard Specifications. In areas where excavation is ordered below the design elevation due to unsuitable soils, Foundation Stone up to 3" minus will be used.

B. Bank run gravel for pavement subbase shall conform to the requirements of Section M.02.01.1 of the Form 818 Standard Specifications.

2.4 ORDINARY BORROW

A. Ordinary borrow shall consist of inorganic granular soils and/or stone having not more than 20 percent by weight passing the No. 200 sieve. The maximum stone size shall be 1 ½ inches for use as select trench backfill or 4 inches for common trench backfill. Borrow shall be well-graded throughout the entire size rnage and shall be free from roots, leaves, or other organic materials. No part of the borrow shall consist of rubbish, trash or garbage in any quantity. Borrow shall also be free of ice or frost and no aggregations of soil particles shall be frozen. The moisture content of the borrow shall be within 3 percent of its optimum moisture content at the borrow source.

B. Ordinary borrow shall be in compliance with the State of Connecticut Department of Transportation Standard Specifications Form 818 Section 2.07 “Borrow”.

2.5 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 Borrow shall be determined by AASHTO-T11 and T27 and shall conform to the following:

Sieve	Percent Passing
½ inch	50 – 85
No. 4	40 – 75
No. 50	8 – 28
No. 200	0 - 10

Maximum size of stone in Gravel Borrow shall be 2 inches.

2.6

2.7 PROCESSED GRAVEL BORROW FOR PAVEMENT SUBBASE

A. The compacted Processed Gravel Borrow to be used for gravel access roads and pavement subbase, or other area where a firm, free-draining subgrade is needed 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.

B. Gradation requirements shall conform to the following for the requirements of CTDOT M.02.06, Grading B.

C. Stockpile the processed materials in such a manner to minimize segregation of particle sizes.

2.8 GRAVEL FOR GRAVEL ROAD RESTORATION

A. Materials for Traffic-Bound Gravel Surface restoration shall consist of sound, tough, durable particles of bank or crushed gravel. All materials shall be free from thin or elongated pieces, lumps of clay, loam, or vegetable matter. Binder may be added and incorporated by approved methods as specified elsewhere.

B. Gradation requirements shall conform to the requirements of CTDOT Form 818, M.02.06, Grading A. Thickness shall match that of the existing road, but in no cases shall be less than 6".

2.9 STONE BORROW

A. Crushed Stone Borrow: Crushed stone borrow shall consist of one of the following materials:

1. Durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated or other objectionable pieces. A detrimental quantity will be considered as any amount in excess of 15% of the total weight. Thin stones shall be considered to be such stones whose average width exceeds 4 times their average thickness. Elongated stones shall be considered to be stones whose average length exceeds 4 times their average width.

2. Durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone with a minimum diameter before crushing of 8 inches.

3. The crushed stone shall be free from clay, loam or deleterious material and not more than 1.0% of satisfactory material passing a No. 200 sieve will be allowed to adhere to the crushed stone.

4. The crushed stone shall have a maximum percentage of wear as determined by the Los Angeles Abrasion Test (AASHTO-T-96) as follows:

   a. For Class 1 Bit. Conc. 30%**

   b. For Cement Concrete Aggregate 45%***

   c. Crushed Stone for Subbase 45%

   **Crushed stone for this use shall consist of crushed or shattered natural rock only. Crushed gravel stone will not be permitted.

   ***Except for 5000 psi or greater cement concrete and prestressed concrete which shall be 30%.

5. The crushed stone shall conform to the grading requirements shown in the following grading Table.

PERCENT BY WEIGHT PASSING THROUGH		
Sieve Size	Minimum	Maximum
1 ½" Crushed Stone		
2"	100	--
1 ½"	95	100
1"	35	70
¾"	0	25
¾" Crushed Stone		
1"	100	--
¾"	90	100
½"	10	50
3/8"	0	20
No. 4	0	5

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 02315.

D. Utilize gravel borrow in all locations where a surface treatment has not been specified but requires a firm finish surface.

E. Processed gravel for pavement subbase is intended to provide a stable foundation for driveways, sidewalk and roadway repair where a gravel base has been specified.

F. Borrow 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.

G. 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.

H. Place all borrow to keep it free of other materials and to prevent segregation.

END OF SECTION

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SECTION 02503

TESTING OF SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Testing of Gravity Sewer Systems

B. Related Sections

1. Section 02958 – Television Inspection of Pipelines

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 TESTING OF GRAVITY SEWER SYSTEMS

A. Test all gravity sewers for allowable leakage by low pressure air test as described herein.

B. No building shall be connected to a newly installed sewer until the sewer has been satisfactorily tested.

1. Low Pressure Air Test

a. After completing backfill of a section of pipe including laterals, conduct a line acceptance test using low-pressure air. Perform the test under the supervision of the Engineer.

b. Seal-test pneumatic plugs before use in the actual test installation. Lay one length of pipe on the ground and seal at both ends with the pneumatic plugs to be checked. Introduce air into the plugs to 25 psig. Pressurize the sealed pipe to 5 psig. Satisfactory pneumatic plugs will hold against this pressure without bracing and without movement of the plugs out of the pipe.

c. After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs have been checked, place a plug in each end of the line (at each manhole), and inflate the plugs to 25 psig. Introduce low pressure air into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. Allow a minimum of two minutes for the air pressure to stabilize. After the stabilization period (3.5 psig minimum pressure in the pipe), disconnect the air hose from the control panel to the air supply. The portion of the line being tested has passed the test if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) is not less than the time shown for the given diameters and lengths in Table 1 at the end of this Section.

d. Air tests shall cover a 1.0 psig pressure drop; 0.5 psig pressure drop tests are not acceptable.

e. In areas where groundwater is known to exist, install a one-half inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. The nipple shall be installed at the time the sewer line is installed. Immediately prior to the line acceptance test, determine the elevation of the groundwater by removing the pipe cap, blowing air through the pipe nipple to remove any obstructions, and then connecting clear plastic tube to the nipple. Hold the hose vertically and measure the height after the water has stopped rising in this plastic tube. Divide the height in feet by 2.3 to establish the pressure in pounds per square inch (psig) that will be added to all readings. (For example, if the height of water is 11.5 feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound per square inch and the timing remain the same.)

f. The maximum starting test pressure should not exceed 9 psig, regardless of groundwater level above the pipe. If the groundwater level is such that the added pressure would be greater than 5.5 psig (12.7 feet), the pipe section may be tested using a starting pressure of 9 psig.

g. Each pipe nipple installed to measure groundwater levels should be recapped subsequent to the air testing procedure to prevent future infiltration.

h. As an alternative to installing a pipe nipple in a manhole to measure the height of groundwater, excavate a test pit over the pipe to determine the height of groundwater.

C. Vacuum Test for Manholes - Gravity Sewer Lines

1. After a manhole has been constructed, conduct a manhole acceptance test using the following vacuum test procedure:

a. Plug all lift holes with an approved non-shrink grout.

b. Plug all pipes entering the manhole, taking care to securely brace the plug from being drawn into the manhole.

c. Place the test head at the inside of the top of the precast concrete cone section and inflate the seal in accordance with the manufacturers' recommendations.

d. Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, measure the time for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than:

1 min. 0 sec. for 0-ft. to 10-ft. deep manholes

1 min. 15 sec. for 10-ft. to 15-ft. deep manholes

1 min. 30 sec. for 15-ft. to 25-ft. deep manholes

e. If the manhole fails the initial test, make repairs with a non-shrink grout. Re-test until a satisfactory test is obtained.

D. Allowable Deflection Test for flexible pipe types including polyvinyl chloride (PVC), high-density polyethylene (HDPE), or polypropylene (PP)

1. Pipe deflection measured not less than 45 days after the backfill has been completed shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (average outside diameter less twice the average wall thickness diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

2. Deflection shall be measured with a rigid mandrel (Go-No-Go) device cylindrical in shape and constructed with a minimum of nine or ten evenly spaced arms or prongs. Submit drawings of the mandrel with complete dimensions for each diameter of pipe to be tested. Hand-pull the mandrel through all sewer and drain lines.

3. Uncover any section of pipe not passing the mandrel and replace the bedding and backfill to prevent excessive deflection. Replace sections of the pipe as necessary. Retest repaired pipe immediately upon backfilling of trench until acceptable.

4. Retest the repaired section of pipeline again, from manhole to manhole, after the 45-day backfill period, until acceptable.

E. Test Failures

1. In case leakage or deflection exceeds the above specified amount, locate the failure and repair it in accordance with applicable Sections of this Contract.

2. Pipelines with shear-type breaks, “fishmouths” or damaged gaskets, cracked bells or couplings, hairline fractures, or structural damage shall be replaced. Mechanical sleeve couplings, poured concrete collars or similar repairs are not permitted. The use of pressure grouting repair techniques will not be allowed without the written consent of the Engineer.

3. After repairs have been made, re-test the line and repeat the process of repairing and re-testing until satisfactory test results, as specified in this Section, are obtained.

F. Alignment of Gravity Sewers and Drains

1. Lay gravity sewers and drains accurately to line and grade.

2. After the pipe is laid and backfill complete, TV inspect the interior of the pipe from manhole to manhole. If excessive deviation in either the horizontal or vertical alignment is observed by the Engineer, the alignment is considered unacceptable.

3. If the alignment is unacceptable due to horizontal displacement, the Contractor will be allowed to construct intermediate manholes at his own expense. If the alignment is unacceptable due to vertical displacement, remove and replace the pipe to the proper grade.

3.2 TESTING OF FORCE MAINS

A. Tests Required on Pressure Systems

1. After the pipeline is constructed, fill pipes with water and test the pipe. Air testing is not allowed.

2. Provide all water required for tests. Provide all temporary plugs, valves, gauges, and connections required for making the tests, and remove such appurtenances at the completion of the test. Install temporary supports, blocking, bracing or ballast as necessary for the stability of the line.

3. Conduct a pressure test and a leakage test simultaneously. The pressure for these two tests shall be measured at the lowest part of the line and shall be either 100% higher than normal operating pressure or 150 psi if the former exceeds 150 psi. Conduct the test for a period of 4 hours or until the Engineer accepts the pipeline.

4. On pipelines where the elevation along the route of construction varies substantially, the Engineer reserves the right to require the Contractor to valve off and test portions of the line separately. The Engineer may also require the testing of individual portions of the line as construction proceeds rather than await completion of the entire project to perform a pressure or leakage test.

5. No pipeline is to be placed under pressure or subjected to hydrostatic pressure until at least 5 days have elapsed after the concrete thrust blocks have been installed. If high early strength concrete is used in the concrete thrust blocks, the hydrostatic pressure can be applied to the main after 2 days have elapsed after thrust block construction.

6. Rubber jointed pipelines may be subjected to hydrostatic pressure and inspected for leakage at any time after the trench has been partially backfilled. Partial backfilling shall consist of backfilling along the center of the pipe length and leaving the joints open for inspection.

7. For pipelines using a rubber type joint, and on other pipelines or at locations approved by the Engineer, the Contractor will be allowed to complete backfilling, prior to undertaking the leakage and pressure tests. Backfilling prior to testing will be the Contractor's option, except for intersections, driveways, crosswalks and other such locations where holding open the trench could adversely affect the public.

B. Procedure

1. Slowly fill each section of pipeline to be tested with water up to normal operating pressure.

2. Expel all air from the pipeline. Make taps at points of highest elevation in the pipeline in order to completely remove all air.

3. After the line has been placed under normal operating pressure and all air has been expelled, start the pressure and leakage test. Raise the pipeline under test to the specified pressure. Furnish a pump, pipe connections, gauges and necessary apparatus and connections to the new main. Raise the pressure in the main to the specified test pressure by means of the pump and maintain the

specified pressure for a period of four hours or until the Engineer indicates that the pipeline is satisfactory.

C. Examination under Pressure

1. Carefully examine all exposed pipes, fittings, valves, and joints during the open-trench test.

2. Remove and replace any cracked or defective pipes, fittings, or valves discovered in consequence of this pressure test with sound material in the manner provided under the applicable pipe section and the test shall be repeated until satisfactory to the Engineer.

D. Leakage Test

1. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the maximum specified leakage test pressure after the pipe has been filled with water and the air expelled.

2. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

in which Q equals the allowable leakage, in gallons per hour; L is the length of the pipe section being tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 10.5 U.S. gal. per 24 hours per mile of pipe per inch nominal diameter, evaluated on a pressure basis of 150 psi.)

TABLE I
Specification Time Required for a 1.0 PSIG Pressure Drop
For Size and Length of Pipe Indicated for Q=0.0015

1	2	3	4	Specification Time for Length (L) Shown (min:sec)							
Pipe Diameter (in.)	**Minimum Time (min:sec)**	**Length for Minimum Time (ft)**	**Time for Longer Length (sec)**	**100 ft.**	**150 ft.**	**200 ft.**	**250 ft.**	**300 ft.**	**350 ft.**	**400 ft.**	**450 ft.**
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Uni Bell PVC Pipe
Association Publication
Uni-B-6-90

END OF SECTION

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SECTION 02514

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Ductile iron pipe and fittings, direct buried or in below grade vaults.
2. Restrained joints and fittings.
3. Cast-in-place concrete anchor blocks and thrust blocks.

B. Related Sections

1. Section 02315 – Excavation, Backfill, Compaction and Dewatering
2. Section 02317 – Underground Warning Tape
3. Section 02503 – Sewer Testing
4. Section 09900 – Painting

1.2 REFERENCES

A. Pipe and fittings shall conform to the latest edition of the following standards unless otherwise specified:

1. ANSI/AWWA C104/A21.4, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. ANSI/AWWA C110/A21.10, Ductile Iron and Grey Iron Fittings 3″ through 48″ for Water and Other Liquids.
3. ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
4. ANSI/AWWA C115/A21.15, Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
5. ANSI/AWWA C150/A21.50, Thickness Design of Ductile Iron Pipe.
6. ANSI/AWWA C151/A21.51, Ductile Iron Pipe, Centrifugally Cast, for Water.
7. ANSI/AWWA-C153/A21.53, Ductile Iron Compact Fittings Water Service.
8. ANSI/AWWA C600, Installation of Ductile Iron Water Mains and their Appurtenances.
9. ANSI/AWWA C800, Underground Service Line Valves and Fittings.
10. ANSI/AWWA C651, Disinfecting Water Mains.
11. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
12. ASTM A536, Standard Specification for Ductile Iron Castings

13. ASTM B88, Standard Specification for Seamless Copper Water Tube.

14. Ductile Iron Pipe Research Association, "Thrust Restraint Design for Ductile Iron Pipe" (Current Edition).

1.3 SUBMITTALS

A. Administrative Submittals

1. Detailed description of proposed pipe handling and installation methods along with the manufacturer's approval of those methods.

2. Construction details and schedule of Work for each connection to existing piping at least 7 days prior to beginning the Work. Approval must be received before commencement of Work on-site.

B. Shop Drawings

1. Manufacturer's drawings and catalog cuts, including descriptive literature indicating product characteristics and conformance with specifications and code requirements. Submit shop drawings for ductile iron pipe; fittings; couplings; filling rings; linings and coatings; and all accessories.

2. Layout and design details.

3. Location for each type of restrained joint or device to prevent joint separation along with installation, assembly and disassembly instructions.

C. Quality Control Submittals

1. Certificates of compliance on pipe materials.

2. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

3. Manufacturer of pipe and Manufacturer of fittings on the project shall have an established, annually audited and certified, quality control procedure for manufacturing of pipe and manufacturing of fittings respectively. Manufacturer shall be certified by an independent, third party auditor for compliance with all requirements of the AWWA standards. The manufacturer shall submit a current certificate of compliance for the plant facility where the pipe or fittings are to be made. Certificate of compliance shall be submitted for each additional year of manufacturing during the duration of the Project. The manufacturer shall not change the plant manufacturing the pipe or fittings during the duration of the Work.

1.4 QUALITY ASSURANCE

A. Pipe and fittings shall be inspected at the foundry as required by the standard specifications to which the material is manufactured. In addition, the Owner reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service, or by the Engineer, at either the manufacturer's plant or other testing laboratory at their own expense.

B. Ductile iron pipe shall be from a single manufacturer. Fittings shall be from a single manufacturer, not necessarily the pipe manufacturer.

C. The Engineer will inspect the pipe and fittings after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery, or at any point during the progress of the Work, shall be marked for identification and shall immediately be removed from the job site and replaced at no additional cost to the Owner.

D. Test pipe under pressure for defects and leakage in accordance with Section 02503.

1.5 PROJECT CONDITIONS

A. Secure permits and pay fees required to carry out the piping work. Comply with laws, ordinances, codes, rules, and regulations of the local and state authorities having jurisdiction over the Work. Where provisions of the Contract Documents are in conflict with the codes, the more stringent shall govern.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. American Cast Iron Pipe Company

B. U.S. Pipe

C. or equal

2.2 PIPE AND FITTINGS - GENERAL

A. Ductile iron pipe shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151. Fittings and other materials referenced in this section shall conform to the latest edition of the references listed in Paragraph 1.2 of this section.

B. Unless otherwise indicated or specified in the Contract Documents, buried ductile iron pipe and fittings shall be Class 52 with push on joints.

C. Unless otherwise indicated or specified, buried pipe shall have an asphaltic exterior coating in accordance with AWWA C110, C151 or C153, as applicable.

D. Unless otherwise indicated or specified in the Contract Documents, buried fittings shall be ductile iron or gray iron with mechanical joints.

E. Unless otherwise indicated or specified in the Contract Documents, ductile iron pipe and fittings installed above ground and/or in buried vaults, shall be Class 53 with flanged joints.

F. Exposed piping shall be shop primed and painted in the field in accordance with Section 09900. Exposed piping to be painted shall not have an asphaltic exterior coating applied.

G. Pipe and fittings shall be cement mortar lined and seal coated on the interior in accordance with AWWA C104. Cement mortar lining shall be twice the standard thickness; tolerance shall be minus 0 inches, plus 1/8 inch.

2.3 PIPE AND FITTING JOINTS

A. Push-on-joints and mechanical joints shall conform to ANSI/AWWA C111/A21.11.

B. Flanged joints shall be assembled with bolts and nuts, bolt studs with nut on each end, or studs with nuts in tapped flanges. Bolts and nuts shall be manufactured in accordance

with ASTM A325, Type 1, Grade 5, hot-dipped galvanized finish, heavy hex head, 120,000 psi minimum tensile strength with X-Heavy nuts. Nuts and bolts shall be provided with an anti-seize, thread lubricating compound.

C. Gaskets for flanged joints shall be full face, 1/8 inch red rubber. Ring gaskets shall be provided for piping 14 inches in diameter and larger.

D. Where indicated on the Drawings, provide restrained joints. Gaskets shall meet the material requirements of ANSI/AWWA A21.11/C111 for mechanical joint gaskets.

E. Restrained joint pipe shall be Flex-Ring®/Lok-Ring® Joint by American Cast Iron Pipe Company, TR FLEX® by US Pipe and Foundry Co., or equal.

2.4 FITTINGS

A. Fittings shall be ductile iron or gray iron.

B. Fittings less than or equal to 12 inches in size shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall have a 350 psi pressure rating.

C. Fittings greater than 12 inches in size shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 and shall have the following pressure ratings:

1. Fittings greater than 12 inches and less than or equal to 24 inches - 350 psi

2. Fittings greater than 24 inches - 250 psi

D. Mechanical joint retainer glands shall be installed on all mechanical joints. Retainer glands shall be specifically designed to fit standard mechanical joint bells with corrosion resistant, high strength, low-alloy T-head bolts conforming to ANSI/AWWA A21.11/C-111 and ANSI/AWWA A21.53/C-153. Retainer glands shall be manufactured of ductile iron conforming to ASTM A536-80, grade 60-42-10. Wedges shall be of hardened ductile iron and require the same torque in all sizes. These devices shall have a minimum 250 psi pressure rating with a minimum safety factor of 2:1 and shall be EBAA IRON, Inc., Megalug® series 1100 or equal. Glands shall be listed with Underwriters Laboratories and/or approved by Factory Mutual.

E. Anchoring tees shall have main run ends as indicated on the Drawings or as required for the installation. The branch shall have a plain end with an integral gland and rotating mechanical joint gland to provide a restrained connection with the adjacent valve or fitting (typically used for hydrant branches).

2.5 COUPLINGS

A. Solid sleeves shall have long body type (12 inches min.) and mechanical joints with retainer glands.

B. Couplings and transitional couplings for pipe less than or equal to 12 inches in diameter shall consist of a long body cast iron sleeve and shall have gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant high strength, low alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Romac style 501, Dresser style 153, Rockwell type 441, or equal. Transition couplings for pipe less than or equal to 12 inches in diameter shall be Dresser Style 162, Rockwell Type 441, Smith Blair Omni Style 442, or equal.

C. Couplings and transitional couplings for pipe greater than 12 inches in diameter shall consist of a steel sleeve with gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant high strength, low alloy steel such as Cor-Ten steel or

an approved equal. Couplings shall be Dresser Style 38, Smith Blair Style 311, Romac Style 400, or equal. Transition couplings for pipe greater than 12 inches in diameter shall be Dresser Style 62, Smith Blair Style 413, Romac Style TC400, or equal.

D. Provide couplings with an exterior epoxy coating.

2.6 GASKETS, GLANDS, NUTS, AND BOLTS

A. Gaskets, glands, nuts, bolts and accessories shall conform to ANSI/AWWA C111/A21.11 or C153/A21.53, as appropriate.

B. Gaskets shall be of plain tipped rubber, suitable for exposure to the liquid within the pipe.

C. Lubricants must be suitable for the type of fluid to be carried by the pipeline and shall be NSF approved for water service.

D. Glands shall be ductile or cast iron.

E. Bolts shall be high strength, low alloy.

F. Requirements for flanged joints:

1. Gaskets for flanged joints shall be full faced red rubber, 1/8 inches thick. Gaskets shall conform to the dimensions of Table A.1 of ANSI/AWWA C115/A21.15. Ring gaskets shall be utilized for joints 14 inches in diameter and larger.

2. Assemble flanged joints with bolts and nuts, bolt studs with nut on each end, or studs with nuts in tapped flanges. Bolts and nuts shall be of low carbon steel conforming to the chemical and mechanical requirements of ASTM A307, 60,000 psi tensile strength, Grade B. Bolts, nuts and studs shall be cadmium plated.

2.7 THRUST BLOCKS AND ANCHOR BLOCKS

A. Concrete shall have a 28-day compressive strength of 3,000 psi.

PART 3 EXECUTION

3.1 GENERAL

A. Deliver, handle, store and install ductile iron pipe in accordance with ANSI/AWWA C600.

3.2 DELIVERY, STORAGE AND HANDLING

A. Delivery of Pipe and Fittings

1. Coordinate delivery of pipe and fittings with installation and unload along the line of work outside the trench near as practicable to the point of final placement, and properly wedged secure. Give minimum 24 hour notice to the Engineer prior to pipe deliveries. Notice shall include the method of unloading.

2. Unload and handle pipe and fittings with a crane or backhoe of proper capacity outfitted with a steel cable sling, belt sling or other specially designed attachment to protect the pipe coating.

3. At the end of each work week, no more than the amount of pipe to be installed the following work week shall remain along the construction route. All pipes remaining along the construction route are to be properly wedged to prevent

movement and not interfere with traffic or pedestrian movement. All excess pipes are to be stockpiled at an approved staging yard in accordance with AWWA C600.

B. Storage of Materials

1. Store pipe in a manner to keep pipe interior free from dirt and foreign matter. Store pipe on wood blocking, rails or other suitable materials. Pipe shall not be stored on stones.

2. Pipe may be stored on top of each other to the maximum stacking height specified by AWWA C600.

3. Protect materials subject to corrosion in accordance with manufacturer's recommendations.

4. If pipe or project materials are stored at the Contractor's approved staging yard, the Engineer shall be permitted reasonable access to the staging yard for inspection of the pipe and materials.

5. Pipe ends shall be sealed tight using polyethylene bags and tape immediately after unloading, regardless of the storage time length, in order to keep foreign matter and wind blown debris out.

6. All fittings are to be stored off of the ground on wooden pallets.

C. Handling Materials

1. Handle materials in such a manner so as to prevent damage to the concrete or mortar coating or lining.

2. Materials are to be handled using methods approved by the pipe manufacturer.

3. Materials damaged during handling will be rejected and shall be replaced at the Contractor's expense.

4. Ensure that no foreign materials enter the pipe and fittings during handling.

3.3 COORDINATION

3.4 DEFECTIVE PIPE

A. Defective pipe or fittings will be rejected for use on this project. Defective pipe is classified as follows:

1. Damage to interior lining

2. Insufficient lining thickness

3. Pipe out of round

4. Damaged pipe barrel area

5. Damaged pipe bells or spigots

6. Missing, misplaced or illegible marking and identification

7. Outside pipe diameter exceeding allowable tolerance

B. If defective pipe is discovered after it has been installed, it shall be removed and replace with sound pipe, at no additional cost to the Owner.

3.5 JOB CONDITIONS

A. Environmental Requirements

1. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

2. Equipment for pipe laying shall be maintained in good operating order.

3. Job site shall be kept clean of debris and organized.

B. Protection

1. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug. This provision shall apply at all times when pipe laying operations are suspended.

C. Work Affecting Existing Pipelines

1. Work on Existing Pipelines:

a. Prior to any work on existing pipelines, remove soils, rust and other debris from the exterior wall of the pipe a minimum of 12 inches beyond the work area.

b. Cut pipes as shown or required with machines specifically designed for this work.

c. Install temporary plugs to keep out all mud, dirt, water and debris.

d. Provide necessary adapters, fittings, pipe and appurtenances required.

e. Cut or tap existing mains at the mid span of a pipe barrel. In no case shall a pipe be cut or tapped within 24 inches of a pipe joint.

3.6 CLEANING PIPE AND FITTINGS

A. Clean and remove foreign matter from the interior of each pipe and fitting before placing in the trench. Remove pipe and fittings whose interior has been contaminated with oil, gasoline or kerosene and replace at no additional cost to the Owner. Remove pipe and fittings whose interior has been contaminated with any material which is a regulated drinking water contaminate or which damages the cement and replace at no additional cost to the Owner. Should foreign material or contaminants be observed in previously installed pipe, cease work until foreign material or contaminated pipe is decontaminated or removed.

B. Remove all lumps, blisters, and excess asphaltic coating from the bell and spigot ends of each pipe or fitting. The outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and be dry and free from oil and grease before the pipe or fitting is laid.

C. On all ductile iron pipe or fittings, the bell of the pipe and the spigot of the adjacent pipe or fitting shall be wire-brushed and cleaned of rust and dirt. The bell of the pipe or fitting and the spigot of the adjacent pipe shall then be lubricated with the joint lubricant furnished with the pipe, and used in accordance with the manufacturer's directions.

3.7 ALIGNMENT AND GRADE

A. Lay and maintain the pipe at the required lines and grades as shown on the Drawings. Fittings shall be at the locations indicated on the Drawings with joints centered, and spigots properly fitted. No deviation shall be made from the line and grade indicated on the Drawings, except with the approval of the Engineer.

B. Joint Openings and Deflection:

1. The maximum allowable joint openings and deflection for push-on joint pipe and restrained joint pipe shall be one-half the manufacturer's maximum allowable opening and deflection.

2. Radius curves indicated on the Drawings or approved during Shop Drawing review shall be made using full lengths of pipe. The use of short lengths of pipe and extra joints in order to make a smaller radius turn will not be allowed without the written approval of the Engineer.

C. Line or Grade Conflicts with Other Structures

1. Wherever obstructions not shown on the Drawings are encountered during the progress of the Work and interfere to such an extent that an alteration in the pipe layout is required, the Engineer will order a deviation from the line and grade at locations where obstructions such as culverts, ducts, wire and/or pipes are encountered. The pipe shall be laid over or under such obstacles with a minimum clearance of 6 inches. The Engineer reserves the right to make the decision to go over or under obstructions during construction.

D. Where underground conditions indicate a change of alignment or grade, such change shall be made only with the written consent of the Engineer.

E. Except at locations indicated on the Drawings by the profile, do not establish high points where air can accumulate.

3.8 PIPE INSTALLATION

A. General Requirements

1. Prepare the pipe trench in accordance with Section 02315.

2. Keep trenches dewatered while installing pipe until all required pipe joints have been made and the trench has been backfilled above the water table to a point where pipe uplift will not occur when the pipe is empty.

3. Carefully lower pipe and fittings into the trench piece by piece by means of a crane, ropes or other tools or equipment, in such a manner as to prevent damage to pipeline materials and protective coatings and linings. Under no circumstances shall pipeline materials be dropped or dumped into the trench.

4. Carefully inspect pipe and fittings for cleanliness and defects prior to placing them in the trench.

5. Install underground warning tape over the pipe in accordance with Section 02317.

B. Laying Pipe

1. Install pipe with a minimum of 5 feet of cover, unless indicated otherwise on the Drawings or directed by the Engineer.

2. Prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe.

3. When laying pipe, the spigot end shall be centered in the bell, the pipe forced home and the joint completely assembled. The pipe shall be adjusted to correct line and grade and secured in place with approved backfill material, properly tamped under and around the pipeline.

C. Cutting Pipe

1. Furnish pipe in full lengths. Cut ductile iron pipe without damage to the pipe or cement lining. The cutting shall be done to leave a smooth end at right angles to the axis of the pipe.

2. Cut ductile iron pipe either by the use of compression-type chain cutters which exert an even continuous force on the wall of the pipe or by power driven abrasive wheels.

3. On ductile iron pipe using rubber joints, the outside edge of the cut end must be tapered back approximately ¼ inch at an angle of about 30 degrees so as to provide for the proper assembly of this joint.

3.9 PUSH-ON JOINTS

A. Push-on joints shall be made in accordance with the manufacturer's instructions. Install gaskets in the pipe bell after lowering the pipe into the trench for installation. Thoroughly clean the bell and spigot of dirt and tar blisters in the trench utilizing a wire brush or bristle brush. Insert rubber gasket in the groove of the bell end of the pipe beginning at the bottom of the bell and working to the top of the bell. Apply lubricant per the manufacturer’s recommendations utilizing a paint brush to the pipe gasket and the pipe spigot to be joined. Place a clean rag under the joint to protect the joint from dirt caused by unintentional grounding of the pipe during jointing. Upon completion, remove the rag. Align the plain end of the pipe to be laid and insert in the bell of the pipe to which it is to be joined and push home with a jack or by other means. After joining the pipe use a metal feeler to make certain that the rubber gasket is correctly located.

3.10 MECHANICAL JOINTS

A. Mechanical joints shall be made in accordance with Appendix A of ANSI A21.11/AWWA C111 and the manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket before assembly. Tighten bolts to the specified torques. Under no conditions shall extension wrenches or an extended handle ratchet wrench be used to secure greater leverage.

3.11 RESTRAINED JOINTS

A. Install restrained joint pipe where indicated on the Drawings. Make the joint assemblies in accordance with the manufacturer's recommendations.

3.12 CONCRETE THRUST BLOCKS

A. Place concrete thrust blocks at locations shown on the Drawings or directed by the Engineer. Cast-in-place thrust blocks shall be formed with wood forms; rough earth forms are not acceptable. Protect pipeline materials and fittings from direct adherence of the concrete thrust block by wrapping in plastic, roofing felt, reinforced manila paper or similar material. The thrust block shall not bear directly on the joint and shall not interfere with future adjustments, tightening, or removal of the joint. Thrust blocks shall bear against undisturbed soil at the side or end of the trench and this undisturbed surface shall be carefully cleaned off so as to be vertical. The thrust blocks shall have a minimum horizontal thickness of 2 feet and shall have the minimum bearing area listed on the Drawings, measured perpendicular to the direction of thrust.

B. Provide thrust blocks and anchor blocks at the locations shown on the Drawings or as Directed by the Engineer.

3.13 TESTING

A. Pipe, fittings and valves installed under this contract shall be tested in accordance with Section 02503, before being placed into service.

END OF SECTION

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SECTION 02515

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. PVC Gravity Pipe and Fittings

2. PVC Pressure Pipe and Fittings

B. Related Sections

1. Section 02315 - Excavation, Backfill, Compaction, and Dewatering

2. Section 02320 - Borrow Material

3. Section 02503 - Testing of Sanitary Sewer and Storm Drainage Systems

1.2 REFERENCES

A. ASTM D2241 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)

B. ASTM D2412 - Standard Test Method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading

C. ASTM D2444 - Standard Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D. ASTM D3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings

E. ASTM D3139 - Standard Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

F. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

G. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

H. ANSI/AWWA C110/A21.10, Ductile Iron and Grey Iron Fittings 3″ through 48″ for Water and Other Liquids

I. ANSI/AWWA-C153/A21.53, Ductile Iron Compact Fittings Water Service

J. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., For Water Distribution

1.3 SUBMITTALS

A. Submit specifications and shop drawings for materials and equipment furnished under this Section.

B. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein.

1.4 QUALITY ASSURANCE

A. Each type of PVC pipe and fittings shall be from a single manufacturer. Alternatively, the pipe manufacturer shall provide certification that the fittings are suitable for installation with the pipe.

B. Inspection of the pipe will also be made by the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gravity Pipe

1. Polyvinyl chloride (PVC) pipe shall be of the size indicated on the Drawings or as specified and shall conform to the latest revision of ASTM D3034, Type SDR 35 for diameters less than or equal to 15 inch diameter and ASTM F679 for pipe greater than 15 inch diameter. Standard laying lengths shall not exceed 14.0 feet.

2. Joints shall be elastomeric gasket joints and shall provide a watertight seal. Gaskets shall be in accordance with ASTM F477. Assembly of joints shall be in accordance with ASTM D3212.

3. The minimum "pipe stiffness" (load divided by change in inside diameter in direction of load application) at 5% deflection shall be at least 46 psi for pipe tested in accordance with ASTM D2412.

4. No shattering or splitting shall be evident when 150 ft.-lbs. and 210 ft.-lbs. is impacted on 4 inch and 6 inch diameter pipe, respectively, in accordance with ASTM Method of Test D2444.

5. Pipe lengths and fittings to be used on the project shall be clearly marked on the outside in bold type with the name of the manufacturer, pipe size, pipe material, pipe class, and ASTM designation.

6. Gravity Pipe Lateral Connections

a. Gravity pipe lateral connection wyes and tees are to be laid in the run of the main pipeline. The wyes and tees shall be the same material as the main line and shall conform in material, joints and class with the line into which they are to be laid.

b. Eighth and sixteenth bends and end plugs are to be of the same material and class or strength designation as the pipe for the house connection.

c. Unless noted on the Drawings, lateral piping shall be 6 inch diameter and shall be of the same material as the main line PVC pipe.

B. Pressure Pipe for shallow gravity sewer installation

1. Polyvinyl Chloride (PVC) pressure pipe shall be of the size indicated on the plans and shall conform to the requirements of the AWWA C900 Standards for PVC900 DR 18 Pressure Pipe for Water with ductile iron pipe equivalent outside diameters. Joints shall use elastomeric gaskets and be in accordance with ASTM D3139. Gaskets shall conform to ASTM F477.

2. The standard laying length shall not exceed 20 feet. The minimum "pipe stiffness" (load divided by change in inside diameter in direction of load application) at 5% deflection shall be at least 46 psi for pipe tested in accordance with ASTM Specifications D2412.

3. Bends shall be constructed of cast iron or ductile iron in accordance with AWWA C110/A21.10 and AWWA C153/A21.53, with mechanical joint ends.

4. Pipe and fittings shall be clearly marked on the outside indicating the name of the manufacturer, nominal diameter, and the ASTM or AWWA designation or both for the DR18 Polyvinyl Chloride Pressure Pipe.

5. Pressure pipe for gravity sewers will only be used where directed by Engineer or Owner.

PART 3 EXECUTION

3.1 HANDLING PIPE AND FITTINGS

A. Take care in loading, transporting, and unloading to prevent injury to the pipe. Do not drop pipe or fittings. Examine pipe and fittings before installing, and no piece shall be installed that is found to be defective.

B. If any defective pipe is discovered after it has been installed, remove and replace it with a sound pipe in a satisfactory manner. Thoroughly clean pipe and fittings before installing, keep clean until they are used in the work, and conform to the lines, grades and dimensions required when installed.

C. Pipe ends requiring cutting shall be cut square without damage to the remaining pipe. Bevel cut pipe ends 1/8 inch at approximately 30 degrees to provide proper assembly of the joint. Beveling can be done with a coarse file or portable grinder.

D. Support stored pipe from below at not more than 3 foot intervals to prevent deformation. Do not stack pipe higher than 6 feet. Store pipe and fittings in a manner which will keep them at ambient outdoor temperatures. Provide temporary shading as required to meet this requirement. Simply covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted.

3.2 INSTALLATION

A. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16 inch per foot of length. If a piece of pipe fails to meet this required check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

B. Install piping and fittings true to alignment and grade. If necessary, each length of pipe shall be cleaned out before installation.

C. Excavation, trenching and back filling procedures shall be in accordance with Section 02315.

D. All PVC gravity pipe shall be installed on a bed of 3/4-inch crushed stone borrow meeting the requirements of Section 02320 and have a minimum depth of 6 inches. The 3/4-inch crushed stone borrow shall also completely encase the pipe and cover the pipe to a grade 6 inches over the top of the pipe for the entire width of the trench. Bell holes shall be made in the 3/4-inch crushed stone borrow bedding such that the pipe shall be uniformly supported throughout the entire length of the barrel section.

E. All pipe shall be tested in accordance with Section 02503.

F. All PVC pressure pipe shall be installed with proper bedding using compacted native materials which provide uniform longitudinal support under the pipe. When an unstable subgrade material is encountered which will provide inadequate pipe support, additional trench depth should be excavated and refilled with suitable material. Initial backfill material should be placed to a minimum one foot over the top of the pipe. Pipe backfill material should be selected and placed carefully, avoiding stones, frozen lumps, and debris.

G. Deflections in Pipe Alignment

1. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory making of the joint, and shall be approved by the Engineer.

2. Prior to deflecting the pipeline, the spigot of the pipeline should be marked flush with the bell end to assure that the spigot is not withdrawn excessively as the result of the deflection. After the pipe is deflected, an adequate depth of jointing material must remain on the side where the spigot is away from home and an adequate width of caulking space must remain on the opposite side of the pipe at the face of the bell.

3. The maximum deflection recommended by the manufacturer when using any pipe system must be observed when deflecting a pipeline.

4. In general, all radius curves called for on the Drawings or permitted at the time of construction are to be made using full lengths of pipe. The use of short lengths of pipe and extra joints in order to make a smaller radius turn will not be allowed without the written approval of Engineer.

H. Unsuitable Laying Conditions

1. No pipe shall be laid in water, in an unsuitable trench or during unsuitable weather conditions.

END OF SECTION

SECTION 02518

VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section is for buried valves, including valves inside below-grade valve vaults. Valves within above-ground structures and buildings are specified in Section 15110.

B. Section Includes

1. Types of valves specified herein include:

a. Gate Valves

b. Check Valves

c. Combination Valves

d. Manual Operators

e. Valve Boxes

C. Related Sections

1. Section 02315 - Excavation, Backfill, Compaction and Dewatering

2. Section 02503 – Testing of Sanitary Sewer and Storm Drainage Systems

3. Section 02514 - Ductile Iron Pipe and Fittings

1.2 REFERENCES

A. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

B. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

C. ASTM A536 – Standard Specification for Ductile Iron Castings

D. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts

E. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications

F. ASTM D429 – Standard Test Methods for Rubber Property Adhesion to Rigid Substrates

G. AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

H. AWWA C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

I. AWWA C207 – Steel Pipe Flanges for Waterworks Service – Sizes 4 Inch Through 144 Inch (100 mm Through 3,600 mm)

J. AWWA C515 - Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

K. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants

1.3 SYSTEM DESCRIPTION

A. Furnish all labor, materials, equipment, and incidentals required to install, complete and ready for operation, all valves and appurtenances as shown on the Contract Drawings and as specified herein.

B. Buried valves for sanitary sewer force mains.

1.4 SUBMITTALS

A. Submit complete Shop Drawings of all valves, valve boxes, hydrants and other material specified in this Section including but not limited to the following:

1. Product data including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

2. Performance and sizing data for air release valves including manufacturer's recommended sizing requirements.

B. Operation and Maintenance Manuals

1. Provide O&M manuals for all valves in accordance with Section 01770.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.

2. Protect valve ends against damage to threads, flange faces, and weld-end preps.

3. Set valves in best position for handling:

a. Set gate valves closed to prevent rattling;

b. Block swing check valves in either closed or open position.

B. Use the following precautions during storage:

1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL

A. Valve sizes shall be the same size as the upstream pipe, unless otherwise indicated.

B. Provide accessories including bolts, nuts, glands, and gaskets.

C. Extended Stems - Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

D. Bypass and Drain Connections - Comply with MSS SP-45 for bypass and drain connections.

E. Valves shall have the same end connections as the pipeline in which it is installed.

F. Provide 125# ANSI B16.1, ANSI/AWWA C115/21.15 standard flange drilling for valves with flanged ends inside buried structures. Provide 1/8 inch full-face red rubber gaskets at all flanged connections.

G. Buried valves shall have mechanical joint ends compatible with the piping systems in which they are installed in accordance with ANSI/AWWA C111/A21.11-85 and Mega-Lug type retainer glands. Provide mechanical joint accessories, including glands, SBR rubber gaskets, tee head bolts, and nuts with the valves. Provide stainless steel bolts and nuts.

H. Mechanical joint ends shall be compatible with ductile iron O.D. pipe.

I. Valves and appurtenances shall be of the size shown on the Contract Drawings.

J. Equipment of the same type shall be from one manufacturer, unless otherwise approved.

K. Valves, hydrants, and appurtenances shall have the name of the manufacturer, flow directional arrows, and the working pressure for which they are designed cast in raised letter upon some appropriate part of the body.

L. Bolts shall be 304 stainless steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

M. Provide buried valves with standard valve box with tee-handle operator.

N. Valves installed inside buried structures shall be hand-wheel or lever operated.

2.2 GATE VALVES (RESILIENT SEAT)

A. Gate valves shall be resilient seat type suitable for underground service complying with the requirements of AWWA C515. C515 gate valves shall be ductile iron.

B. Gate valves shall be designed to be bubble tight for 250 psig water working pressure with no leakage past the seat from either side of the disc, and shall be hydrostatically tested to 500 psig.

C. Gate valves shall be of the non-rising stem (N.R.S.) design.

D. Gate valves shall be set vertically (spur gearing).

E. Gate valves shall open left (counter-clockwise).

F. Buried gate valves shall be furnished with 2 inch square operating nuts.

G. Open-left gate valves shall have a black-painted operating nut, and open-right valves shall have a red-painted operating nut.

H. Cast iron shall meet the specifications of ASTM A126, Class B. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed. Ductile iron shall meet the standards of ASTM A536.

I. The resilient-seated disc wedge shall be of the resilient wedge fully supported type, either cast iron or ductile iron. Solid guide lugs shall travel within channels in the body of the valve. The disc and guide lugs shall be fully encapsulated in SBR (styrene butadiene rubber) or EPDM rubber. Disc wedges that are not 100% fully encapsulated shall not be acceptable. Provide guide caps of an acetal copolymer bearing material to protect the rubber-encapsulated solid guide lugs from abrasion for long life and ease of operation.

J. The seat shall be SBR or EPDM rubber, matching the disc encasement. The seating surface (rubber) shall be specially designed so as to provide a smooth waterway, without depressions or cavities, which might trap debris and interfere with tight closures.

K. The body, bonnet, and gate shall be cast/ductile iron, constructed in accordance with AWWA C515. The bonnet to body seal shall incorporate a flat neoprene gasket. Bonnet and body flanges shall be fully machined to assure proper sealing of the gasket.

L. Gate valve stems shall be of bronze rolled bar stock in accordance with ASTM B584, and shall have a forged thrust collar. The thrust collar shall be factory lubricated, and the thrust collar and its lubrication shall be isolated by the O-Rings from the water way and from outside contamination, providing permanent lubrication for long term ease of operation. An anti-friction thrust washer shall be provided both above and below the thrust collar for ease of operation.

M. Gate valves shall have O-Ring sealed stems with one O-Ring located below the thrust collar and two O-Rings located above the thrust collar. The two O-Rings located above the thrust collar shall be replaceable with the valve still in service in the fully open position.

N. Gate valves shall be as manufactured by U.S. Pipe Metroseal (Model 250), Mueller (Model 2360), American Flow Control (AFC-2500), Clow (2630 Series), equivalent by M&H Valve Company, or equal.

2.3 SWING CHECK VALVES

A. Check valves shall be all iron body, bronze mounted, full opening swing type.

B. Valve clapper shall swing completely clear of the waterway when valve is full open, permitting a "full flow" thru the valve equal to the nominal pipe diameter.

C. Check valves shall comply with AWWA Standard C-508 latest revision.

D. Check Valves shall be rated at 175 psi water working pressure, 350 psi hydrostatic test for structural soundness.

E. Seat tightness at rated working pressure shall be in accordance with AWWA C508.

F. Swing check valves shall be rated for 150 psig.

G. Check valves shall be furnished with 125# ANSI flanged ends.

H. All cast iron shall conform to ASTM-A-126 Class B.

I. Castings shall be clean and sound without defects that will impair their service. No plugging or welding of such defects will be allowed.

J. Clapper shall be all bronze for sizes through 4 inch and cast iron, bronze faced for sizes 6 inch and larger.

K. Hinge pins shall be 18-8 Stainless Steel rotating in bronze plugs.

L. Bolts shall be electro-zinc plated steel with hex heads and hex nuts in accordance with ASTM A-307 and A-563, respectively.

M. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the service pipe.

N. Glands shall be O-rings.

O. Check valves shall be equipped with adjustable outside lever and spring or lever and weight to accomplish faster closing and to minimize slamming effect.

P. Bosses shall be provided on check valves which may be tapped for draining or used for by-pass.

Q. Coat the inside and outside of valves together with the working parts, except bronze and machined surfaces, in accordance with AWWA C-550.

R. Marking shall be in accordance with AWWA C-508 and shall include size, working pressure, and cast arrow to indicate direction of flow, name of manufacturer, and year of manufacture.

S. Check valves shall be Style 159 (outside lever and weight) or 259 (outside lever and spring) as manufactured by M&H Valve Co., Mueller, or equal.

T. Clapper seat to be bronze, rubber faced.

2.4 DUCKBILL CHECK VALVES

A. Duckbill check valve body and bolting material shall be resistant to moderate chemicals commonly found in storm and sanitary sewage, including hydrocarbons, fats, oils, organic and inorganic acids, alcohols, bases, and ketones.

B. When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure shall force the bills of the valve open, allowing flow to pass. When backpressure exceeds the line pressure by the same amount the bills of the valve shall be forced closed.

C. Check valves shall be the flow operated check type with an internal expansion clamp end connection. The port area shall allow passage of flow in one direction while preventing reverse flow. The cuff and duckbill shall be one-piece neoprene construction with nylon reinforcement.

D. Provide flow test data from an accredited hydraulics laboratory confirming pressure drop data. Company name, plant location, valve size and serial number shall be bonded to the check valve. Valves shall be manufactured in the U.S.A.

E. Manufacturers

1. Provide Series 35 in-line check valves and appurtenances as manufactured by Red Valve Co., Inc. of Carnegie, PA 15106 or equal.

F. Materials

1. Valve body: Neoprene

2. Stainless steel for backup ring: ASTM A276, Type 316

2.5 SEWAGE COMBINATION VALVE

A. Provide sewage combination valves at the locations shown on the Drawings.

B. Valves shall automatically release air in pipelines during filling and allow air to enter the pipeline during draining. After operating, the valve shall automatically re-seat tightly.

C. The compound lever shall allow air in or out, depending on conditions.

D. Single body construction.

E. Valve shall have a cast iron body, stainless steel float, rubber-viton seat, and composition cover gasket. Float, stem, and plug shall be stainless steel.

F. The overall height and width of the valve, complete with backflush assembly, shall be no more than 26 inches and 12 inches, respectively.

G. Provide the standard screwed end at the inlet.

H. The backflush assembly shall include a 5 foot fabric-reinforced nitrile hose, bronze shut-off valves, and galvanized quick connects. Provide inlet and outlet shutoff valves.

I. Acceptable manufacturers include:

1. Golden-Anderson (Model 2SAV).

2. Flomatic Corporation (Universal Sewer Valve – Sewair Combo – Model 6650).

3. APCO Valve & Primer Corporation (Model 443).

4. Crispin (Universal Sewer Valve –Model US3621)

5. Val-Matic (Wastewater Combination Air Valve – Model 801ABW)

J. There shall be no spilling or spurting at pressures equal to or less than 20 psi.

K. Paint exterior with universal metal primer.

L. Provide inlet and blow-off valves with a single body and double orifice at each sewage combination valve. The inlet shall be 2 inch NPT and the outlet shall be 1 inch NPT. The small orifice shall be 7/32 inches in diameter and rated for a maximum working pressure of 150 psi.

M. Provide an interior epoxy coating for corrosion protection for sewage installations.

2.6 MANUAL OPERATORS

A. Provide lever handles for quarter-turn valves 4 inches and smaller. Provide one lever handle for each valve supplied.

B. Equip valves 6 inches and larger with gear actuators capable of withstanding an overload input torque of 450 ft/lbs at full open or closed positions without change to the valve or valve operation. All gearing shall be enclosed with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator housing shall be cast iron (ASTM A126 Class B).

C. Manual actuator hand wheels shall be furnished on valves 6 inches and larger. Valves shall be mounted vertically with right angle drive actuators. All components of the

actuators shall be designed to withstand, without damage, a pull of 200 pounds as required by AWWA C504 - Section 12.3. Actuators shall be designed to close with an effort of less than 40 pounds torque.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

C. Examine threads on both the valve and the mating pipe for form (i.e., out-or-round or local identification) and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

F. Replace defective valves with new valves.

3.2 VALVE INSTALLATION

A. Refer to the Drawings and piping system specification Sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install valves in horizontal piping with stem at or above the center of the pipe.

E. Install valves in a position to allow full stem movement.

F. Install valves and actuators to be plumb in the vertical direction.

G. Threaded Connections

1. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

2. Align threads at point of assembly.

3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

4. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

H. Mechanical Joint Connections

1. Refer to Section 02514 for requirements for installing mechanical joint connections.

I. Flanged Connections

1. Align flange surfaces parallel.

2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.3 INSPECTION AND TESTING

A. Valves and hydrants shall be inspected and tested in conjunction with the pipelines in which they are installed in accordance with Section 02503.

3.4 FIELD QUALITY CONTROL

A. After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.5 CLEANING

A. Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.6 FINAL ACCEPTANCE AND WARRANTY

A. Final acceptance of all equipment furnished under these Specifications will be withheld until after the installation and field testing by the Engineer. The manufacturer and the Contractor shall guarantee the equipment against defects of any kind for a period of one year after final testing and acceptance.

END OF SECTION

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SECTION 02530

MANHOLES AND CATCH BASINS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Precast concrete manholes

2. Cast iron manhole frames and covers

B. Related Sections

1. Section 02503 - Testing of Sanitary Sewer 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 all details of construction, including, but not limited to, structure dimensions, reinforcing, joints, and pipe connections to structures.

B. Submit on all materials and products included in this specification, including, but not limited to, manhole rungs, manhole frames and covers, dampproofing coating, brick masonry, mortar, and non-shrink water-proof grout.

C. Submit weights of manhole frames and covers.

D. 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 Owner. 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 Owner.

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 shall be designed for lateral earth pressures and to resist flotation.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE MANHOLE 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.

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, they shall be immediately removed from the site of the work and satisfactory bricks substituted, at no additional cost to the Owner.

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 or ASTM A48, Class 35B.

B. Manhole frames and covers shall comply with the detail shown on the Drawings.

C. Manhole frames and covers shall be designed for a minimum of AASHTO HS20-44 loading.

2.4 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.

2.5 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.

2.6 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.

2.7 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 equal.

2.8 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 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: 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 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 to final grade prior to placement of final paving.

3.2 TESTINIG

A. Test sewer manholes in conjunction with the pipeline in accordance with Section 02503.

3.3 CLEANING

A. Clean new manholes of silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

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SECTION 02535

BREAKING INTO EXISTING MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Breaking through the walls and inverts of existing manholes.

2. Connecting new pipes to existing structures.

3. Ancillary work associated with making the new connections to the existing structures.

1.2 REFERENCES

A. ASTM C443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Piping Using Rubber Gaskets.

B. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

1.3 SUBMITTALS

A. Submit shop drawings showing pipe connection details.

1.4 QUALITY ASSURANCE

A. Personnel shall have confined space entry training as appropriate for the work to be performed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Flexible Pipe-to-Structure Connectors

1. The flexible connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.

2. 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.

3. The external bands shall be made entirely of 304 series non-magnetic stainless steel.

4. The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.

5. The flexible connectors shall meet the following criteria, in accordance with ASTM C923:

a. Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.

b. Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.

c. Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

B. Non-shrink, water-proof grout

1. Non-shrink, water-proof grout shall be Hallemite; Waterplug; Embeco; or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Core drill into existing structures in such a fashion as to make an opening of suitable size to accommodate the connecting pipe without excessive damage to the existing structure.

B. Manholes

1. For manholes, break out and rebuild existing inverts as required to provide an adequate base under the new channels being installed, and shaped to provide smooth continuous hydraulic flow through the manhole.

2. Control existing flows as required during the period of construction. No sewage will be permitted to flow directly against concrete or other masonry work until it is at least 48 hours old.

a. Temporary handling of sewage flows may be accomplished by inserting pipes from the inlet to the outlet of the manhole and by using temporary plugs, where appropriate, provided that such pipes do not interfere with satisfactory completion of the work and shaping of the inverts, nor cause excessive backing-up in the existing system upstream of the diversion. In cases where this type of temporary handling of flows is not possible, provide the necessary dams, plugs, etc., as required in upstream manholes, and pump the flow around the structure under construction.

b. When sewage is pumped or otherwise diverted around a particular structure, it shall be discharged back into the sewage system through existing downstream manholes. Under no circumstances shall sewage be permitted to run onto the surface of the ground.

C. Pipe Connections

1. Rebuild and tightly close existing manhole walls and inverts to provide an integral, water-tight structure around the new pipes.

2. For pipes with smooth exterior surfaces (PVC, ductile iron, HDPE, steel, etc), use flexible pipe-to-structure connectors.

END OF SECTION

SECTION 02740

HOT MIX ASPHALT (HMA) PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Hot mix Asphalt (HMA) paving, permanent, wearing, and binder course for roads

2. Temporary HMA pavement trench repair in roadways

3. Permanent HMA Milling/Trench Repair

4. Full-Width Overlay

5. Bituminous Concrete Curb

B. For the purposes of this Section, Hot Mix Asphalt (HMA) and bituminous concrete have the same meaning.

C. Related Requirements

1. Section 02315 - Excavation, Backfill, Compaction and Dewatering

1.2 REFERENCES

A. State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction Form 818," as amended

B. ASTM D2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

C. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 1990 Edition, as amended

D. AASHTO M 320

E. TAI - (The Asphalt Institute) - MS-3 Asphalt Plant Manual

F. TAI - (The Asphalt Institute) - MS-8 Asphalt Paving Manual

1.3 SUBMITTALS

A. Job mix formula for each mix specified under this Section.

B. Certificate indicating the mixes specified meet or exceed the requirements specified herein.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction Form 816".

B. Mixing Plant: Conform to State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction Form 816.

C. Obtain materials from same source throughout.

PART 2 PRODUCTS

2.1 MATERIALS

A. General

1. Bituminous materials shall conform to the requirements of these Specifications.

2. Bitumen delivered to a project or to a mix plant must be accompanied by a proper certificate signed by the producer's authorized representative. Shipments of material not accompanied by a certificate will not be accepted for use in the Work.

B. Hot Mix Asphalt Paving shall be Superpave S0.5 and S1.0 in accordance with the details shown on the Drawings and the requirements of State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction Form 818".

PART 3 EXECUTION

3.1 PAVING – GENERAL

A. Maintain pavement under this Contract during the guarantee period of one year and promptly (within 3 days of notice given by the Engineer) refill and repave areas which have settled or are otherwise unsatisfactory for traffic.

B. All pavement thicknesses referred to herein are compacted thicknesses. Place sufficient mix to ensure that the specified thickness of pavement results.

C. Regardless of temperature, no permanent mix conforming to the requirements of these specifications shall be placed after October 31 or before May 1 of any year.

D. When the air temperature falls below 50ºF, extra precautions shall be taken in drying the aggregates, controlling the temperatures of the materials and placing and compacting the mixtures.

E. Existing drainage patterns shall not be altered by the new pavement construction unless otherwise shown on the Drawings.

F. Furnish and spread calcium chloride on disturbed surfaces to control dust conditions when necessary, or upon direction of the Engineer.

G. In no case will pavement be placed until the gravel base is dry and compacted to at least 92.0% maximum density at optimum moisture content.

H. All pavement edges that have been damaged shall be sawcut again if necessary to re-establish a straight clean line between the existing pavement and trench patch.

I. Tack Coats

1. Apply tack coat on the binder prior to placing the top course. The tack coat shall be RS-1 emulsion and shall be applied at a rate of 0.05 gallons per square yard on binder courses.

2. The edges of the existing pavement where the joints are to be formed shall be thoroughly coated with tack coat to ensure adhesion between the two pavements.

3. The contact surfaces of curbs, castings, and other structures shall be painted with a tack coat prior to placement of paving.

J. Place temporary HMA as soon as possible after the gravel base has been prepared, shaped and compacted for all streets, driveway and sidewalk repair. Temporary HMA shall be placed no later than the Friday following the work.

K. Until such time as the final paving is performed, maintain all temporary HMA by filling any holes that may develop and by adding additional bituminous material to maintain the surface of the trench even with the adjacent pavement.

L. No pavement used as temporary trench repair shall remain as part of a final or permanent repair.

M. Top course mixes shall provide for 4% air voids in the finished product. The initial in-place voids shall not exceed 7.5%. Final in-place voids shall not be below 2.5%. Additional asphalt content shall not be added for the sole purpose of reducing the in-place voids. If the in-place voids are too high or the paving is expected to occur during cold weather, more compactive effort will be required to adjust the void content rather than increasing the asphalt content.

N. Breakdown rolling shall not occur before the HMA has cooled to a temperature of 320 degrees Fahrenheit, and shall be completed before the HMA mat has cooled to a temperature of 275 degrees Fahrenheit. Intermediate rolling shall be completed prior to the HMA mat attaining a temperature of 200 degrees Fahrenheit. Finish rolling shall be completed prior to the HMA mat attaining a temperature of 150 degrees Fahrenheit. Roller and paver speeds shall be agreed upon with the Engineer prior to placing HMA to ensure mix temperature requirements will be met.

O. Thermal segregation of the HMA shall be limited to a maximum of 20 degrees Fahrenheit.

P. Cascading HMA material on the top of the finished mat with rakes or shovels will not be permitted. Coarse Aggregate dislodged as a result of unavoidable hand work shall be removed from the surface prior to rolling.

Q. Place and compact HMA materials by steel-wheeled rollers of sufficient weight to compact the HMA to 92.5% of the calculated **T**heoretical **M**aximum **D**ensity (TMD) in accordance with ASTM D2041.

R. Along curbs, structures and all other places not accessible with a roller, the paving mixture shall be thoroughly compacted with tampers. Such tampers shall not weigh less than 25 pounds and shall have a tamping face no more than 50 square inches in size. The surface of the mixture after compaction shall be smooth and true to the established line and grade.

S. No vehicular traffic shall be permitted on the newly completed pavement until adequate stability has been attained and the material has cooled to below 140 degrees Fahrenheit or sufficiently to prevent distortion or loss of fines. HMA delivery trucks (loaded or empty) shall not be permitted on the newly completed pavement until the asphalt has cooled to below 90 degrees Fahrenheit. If the climatic or other conditions warrant, the period of time before opening to traffic may be extended at the discretion of the Engineer.

T. Following all paving, the area along the edge of all pavement shall be backed up with gravel, or loam and seed as required, so that it is flush with the adjacent paving. Whenever possible, the final surface of the backup material shall slope away from the surface edge for drainage runoff.

U. Following all paving, clean all catch basins and remove and dispose of all debris.

3.2 TEMPORARY HMA TRENCH REPAIR IN ROADWAYS

A. All manhole frames, catch basin frames and utility boxes are to be set to the grade of the trench patch until such time that permanent paving is performed. They shall then be adjusted as required by the type of permanent paving called for in this Section. Frames and utility boxes shall not be allowed to protrude above the surface of the trench patch.

B. Prior to the excavation, sawcut the existing pavement in the vicinity of the work to prevent damage to the pavement outside of the specified paylines and/or the requirements of construction. Sawcut shall be straight and neat in appearance, any milled areas adjacent to the trench patch area shall have the edges sawcut.

C. Immediately after completing the backfill, or in no event later than the end of the work day, place and compact process aggregate/bank run gravel subbase in 2 lifts per detail. All temporary pavement and structures shall be set to the existing roadway elevations. Care shall be taken to avoid the formation of puddles.

D. A temporary HMA top course with a thickness as specified in the Drawings shall then be placed and compacted so that the upper surface shall provide the proper roadway cross-section.

E. After a period of 30 days, or such other period as determined by the Engineer, has elapsed, proceed with the permanent road construction as shown on the Drawings.

3.3 PERMANENT HMA MILLING/TRENCH REPAIR

A. Permanent trench repairs may only occur after a period of 30 days, or such other period as determined by the Engineer, has elapsed.

B. At the time of permanent patching, remove any temporary HMA trench patch or gravel materials to a depth as specified in the Drawings below the adjacent grade. Then sawcut the existing pavement beyond the edges of the trench to expose one foot of undisturbed soils and remove pavement on either side of the trench.

C. All manhole frames, catch basin frames and utility boxes are to be lowered prior to placement of the permanent patch. After placing the permanent patch, they shall be raised to the grade of the patch until such time as the top course is placed, unless the period of time between the placement of the patch and the placement of the top course is less than 2 weeks, in which case the frames may be raised to the grade of the top course. All excavated materials removed for raising of the frames and utility boxes are to be replaced with concrete. This ring of concrete shall be filled flush with the surrounding patch.

D. An HMA binder of the required thickness as specified in the Drawings shall then be placed and compacted to the appropriate elevation to allow the top course to be placed flush with the existing pavement.

E. Once binder course has been installed over the trench, existing roadway shall be milled to the extent shown on the Drawings. Then place and compact HMA as specified in the Drawings, using a paving screed so that the upper surface is flush with the existing roadway after compaction.

F. The final surface shall be properly graded and cambered to provide a smooth surface of proper cross-section and blended into all adjacent existing pavements. Any permanent

pavement repair that in the opinion of the Engineer does not meet this requirement, or that will form puddles 1/16-inch deep or greater shall be repaired or replaced at the Contractor's expense.

3.4 FULL-WIDTH OVERLAY

A. Roads shall be cold planed as shown on the Drawings and as specified herein in preparation for the full-width binder and/or top course.

B. Prior to the start of spreading the permanent HMA top course the road surface shall be prepared. This shall include, but not be limited to sweeping, repairing, removing of debris, adjustment of all structures for the finished, compacted overlay thickness, and tack coating the surface of the road to be overlaid.

C. Surface preparation shall also include filling and shimming all trench repair and pavement areas that have not been milled, reclaimed or reconstructed which require preparation prior to the placement of the overlay. Overlays shall not be placed over pavement areas with open seams, substantial cracks, pot-holes, depressions or other defects until proper filling and shimming has been completed.

D. Top course for an overlay shall be laterally "toed-in" to the existing pavement with a 2 foot minimum keyway cut with milling machines.

E. When top course is placed on a new binder course, a butt joint shall be provided between new pavement and any adjoining road surfaces.

F. The final surface shall be properly graded and cambered to provide a smooth surface of proper cross-section and blended into all adjacent existing pavements. Any permanent pavement repair that in the opinion of the Engineer does not meet this requirement, or that will form puddles 1/16-inch deep or greater shall be repaired or replaced at the Contractor's expense.

G. The finished top course shall blend smoothly with all rim elevations of catch basins, manhole covers, gate box covers, and any other utilities, and shall in no way interfere with or alter the existing surface drainage.

3.5 BITUMINOUS CONCRETE CURB

A. Install 6” thick compacted gravel base below proposed curb.

B. The shape of the new curb shall match the existing curb as closely as possible.

C. Closure between curb installed hereunder, and existing curb shall be the same shape and texture as the machine installed bituminous concrete curb.

D. The ends of the existing curb shall be cut with a saw prior to construction of bituminous concrete curb repairs.

E. Construction methods and procedures for bituminous concrete curb shall be in accordance with State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges and Incidental Construction Form 818,” as amended.

END OF SECTION

SECTION 02820

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Installation of fence framework, fabric, and accessories; excavation for post bases; concrete foundations for posts and center drop for gates; and manual gates and related hardware as shown on the plans and specified herein.

1.2 REFERENCES

A. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless

B. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products

C. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

D. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners

E. ASTM A392 – Zinc-Coated Steel Chain-Link Fence Fabric

F. ASTM A428 – Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles

G. ASTM A491 – Aluminum Coated Fabric Wire

H. ASTM A569 – Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality

I. ASTM A653 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-dip Process

J. ASTM A792 – Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-dip Process

K. ASTM A824 – Metallic Coated Steel Marcelled Tension Wire for Use with Chain Link Fence

L. ASTM B429 – Aluminum-Alloy Extruded Structural Pipe and Tube

M. ASTM C94 – Ready Mixed Concrete

N. ASTM F567 – Practice for Installation of Chain Link Fence

O. ASTM F668 – Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric

P. ASTM F900 – Industrial and Commercial Swing Gates

Q. ASTM F934 – Standard Colors for Polymer-Coated Chain Link Fence

R. ASTM F1043 – Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework

S. ASTM F1083 – Pipe, Steel, Hot-dipped Zinc-Coated (Galvanized) Welded, for fence Structures

T. ASTM F1184 – Industrial and Commercial Horizontal Slide Gates

U. CLFMI (Chain Link Fence Manufacturers institute) – Product Manual

1.3 SUBMITTALS

A. Shop drawings showing the plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates and a schedule of components.

B. Data indicating compliance with these specifications for the fabric, posts, accessories, fittings and hardware.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Supply material in accordance with CLFMI – Product Manual.

C. Perform installation in accordance with ASTM F567.

D. Furnish a 10-year factory warranty against corrosion and rust for the entire fencing system.

1.5 PRODUCT HANDLING

A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

B. Packages shall be labeled with the manufacturer's name.

C. Store fence fabric and accessories in a secure and dry place.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Material furnished shall be new and first quality and shall not have been painted. Steel shall be copper bearing, containing not less than 0.2% pure copper. Materials are to be galvanized, then PVC coated - color to be selected by the Owner.

B. Framing (Steel): ASTM F1083 Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 25 ksi; coating conforming to ASTM F1043 Type A on pipe exterior and interior.

C. Fabric Wire (Steel): ASTM F668 PVC coated.

D. Concrete: ASTM C94; Air Entrained Portland Cement, 3,500 psi strength at 28 days, 3 inch slump; ¾ inch nominal sized coarse aggregate.

2.2 COMPONENTS

A. Line Posts: 2.5 inch diameter.

B. Corner and Terminal Posts: 3 inch, weighing 5.7 lbs/LF.

C. Gate Posts: 4 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 2 inch diameter weighing 2.72 lb/sLF for welded fabrication.

F. Fabric: 2, inch diamond mesh interwoven wire, 9 gage thick, top selvage knuckle end closed, twisted tight, bottom selvage twisted tight, knuckle end closed.

G. Tension Wire: 9 gage thick steel, single strand, ASTM A824.

H. Tension Band: steel.

I. Tension Strap: steel.

J. Tie Wire: Aluminum alloy steel wire.

K. Fastener Hardware: ASTM A307

2.3 ACCESSORIES

A. Caps: Cast steel galvanized, sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Gate Hardware: Fork latch with gravity drop, mechanical keepers; three 180 degree gate hinges for each leaf and hardware for padlock. Hinges shall be non lift-off design

2.4 GATES

A. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.

B. Fabricate gate frames from 2 inch outside diameter pipe weighing 2.72 lbs/l.f. unless noted otherwise.

C. Factory assemble gates.

D. Gates are to be the same height as the main fence unless noted otherwise.

E. Conform to requirements specified for PVC coated steel chain link fence except that PVC coated aluminum alloy framing conforming to ASTM B429 may be used.

F. Design gates for operation by one person.

2.5 SLIDING GATES

A. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.

B. Secure rollers to post or frame without welding.

2.6 CANTILEVERED SLIDING GATES

A. Fabricate gate leaf frames and tracks of aluminum conforming to ASTM B429 alloy 6063-T6 or as required to meet performance requirements of ASTM F1184 and specified performance requirements.

B. Frame Members: Minimum 2 inch 0.91 lb/ft aluminum tubing welded assembly forming rigid, one piece unit.

C. Install fabric securely stretched and held in center of tubing.

D. Brace cantilever overhang frames with 3/8 inch brace rods. For gate leaf sizes greater than 23 feet, fabricate with additional lateral support rail welded adjacent to top and bottom horizontal rails.

E. Provide minimum overhang for each leaf opening size as follows:

Opening	Overhang
Up to 10'-0"	6'-6"
10'-0" – 14'-0"	7'-6"
14'-1" – 22'-0"	10'-0"
22'-1" – 30'-0"	12'-0"

F. Track: Combined, integral track and rail.

G. Rail: Aluminum extrusion; minimum total weight of 3.72 lb/ft; designed to withstand reaction load of 2.000 lbs.

H. Roller Track Assembly: Two swivel type, zinc, die cast trucks having four, sealed lubricant ball bearing wheels minimum 2 inches diameter by 9/16 inches width designed for same reaction load as rail. Provide two side-rolling wheels for each gate leaf to maintain alignment of truck in track.

I. Fasten trucks to post brackets by minimum 7/8 inch diameter, ½ inch shank ball bolts.

J. Provide galvanized steel guide wheel assemblies consisting of two rubber wheels of minimum 4 inch diameter with oil-impregnated bearings for each supporting post.

K. Attach guide wheel assembly to post so bottom horizontal member rolls between wheels and permitting adjustment to maintain plumb gate frames and proper alignment.

2.7 FINISHES

A. Components and Fabric: Galvanized to ASTM A53; ASTM A123; ASTM A153, ASTM A653 for components; ASTM A392 for fabric; 1.8 oz/sq ft coating.

B. Components and Fabric: Vinyl coating, color per Owner in accordance with ASTM F934 over galvanized coating to ASTM A53; ASTM A123; ASTM A153, ASTM A653 for components; ASTM A392 for fabric of 1.8 oz/sq ft galvanizing.

C. Vinyl Components: color to match fabric.

D. Hardware: Galvanized to ASTM A153, 1.8 oz/sq ft coating.

E. Accessories: Same finish as framing, fabric.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fence with posts vertical and components to line and grade shown on Drawings.

B. Install posts with 6 inch maximum clear opening from end posts to buildings, fences and other structures.

C. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.

D. Post holes shall have a plan diameter 12 inches greater than the post diameter and a minimum depth of 42 inches. Holes shall be clean and free of loose soil and debris.

E. Line Post Footing Depth Below Finish Grade: ASTM F567, 4 feet.

F. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567, 4 feet.

G. Set chain link fence posts in air-entrained 3,000 psi, ¾ inch concrete. Embed posts a minimum of 3'-0". Concrete shall be placed continuously in one operation and tamped or vibrated for consolidation.

H. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

I. Extend concrete footings 1inch above grade, and trowel, forming crown to shed water.

J. Fill gate posts with the above specified concrete prior to the installation of gates.

K. Where solid rock is encountered line posts shall be set to a minimum depth of 12 inches, and end, corner, gate and intermediate post to a minimum of 18 inches in the solid rock. The hole shall have a minimum width or diameter 1 inch greater than the largest dimension of the post section to be set. After the post is set and plumbed the hole shall be filled with grout consisting of one part Portland cement and one part clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids.

L. Rails, Bracing, and Fabric - Concrete shall attain 75% of the 28 day strength before rails, tension wires and/or fabric is installed. A minimum of 7 days shall pass before installation of the above items. Fabric shall not be stretched and tensioned or gates hung until the concrete attains full strength. Fabric shall be installed with two inches clear space to finish grade.

M. Set intermediate, terminal, and gate, posts plumb, in concrete footings with top of footing 1inch above finish grade. Slope top of concrete for water runoff.

N. Line post spacing shall be a maximum of 10'-0" center to center.

O. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

P. Corner and terminal posts are to be braced horizontally and diagonally. The braces are to extend over one adjacent panel. Changes in line of 30 degrees or more shall be considered as corners.

Q. Install top rail through line post tops and splice with 6 inch rail sleeves.

R. On curves with a radius less than 500 feet the top rail shall be bent true to the curve.

S. Install center, and bottom brace rail on corner gate leaves.

T. Install framework, fabric, gates, and accessories in accordance with ASTM F567.

U. Place fabric on inside of posts and rails.

V. Install nuts for tension bands and hardware bolts on the side of the fence opposite the fabric.

W. Stretch fabric between terminal posts.

X. Position bottom of fabric 3 inches above finished grade.

Y. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

Z. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

AA. Install bottom tension wire, strap stretched taut between terminal posts.

BB. Support gates from gate posts. Do not attach hinged side of gate from building wall.

CC. Install gate with fabric to match fence. Install three hinges on each gate leaf, latch, catches, drop bolt, foot bolts and sockets, torsion spring retainer, retainer and locking clamp.

DD. Miscellaneous - Install nuts for tension bands and hardware bolts on the side of the fence opposite the fabric. Repair galvanized coating where damaged using hot-applied repair compound applied in accordance with the manufacturer's recommendations.

EE. Repair damage to galvanized coating using hot-applied repair compound in accordance with the manufacturer's recommendations.

3.2 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼ inch in 8 feet.

B. Maximum Offset From Indicated Position: 1 inch.

END OF SECTION

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SECTION 02920

LAWNS AND GRASSES

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. Loam, starter fertilizer, lime, lawn seed, and hydric seed

3. Sodding

4. Mulch

1.2 SUBMITTALS

A. Lawn seed mixture including percent by weight of each seed type, and manufacturer/Supplier name.

B. Suitable laboratory analysis of the topsoil to determine the quantity of fertilizer and lime to be applied.

C. Lime and starter fertilizer application rates based on laboratory soil tests.

D. 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.

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.

PART 2 PRODUCTS

2.1 MATERIALS

A. Loam

1. Loam from offsite, as required for Work, shall be taken from a well-drained, arable site, and shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Loam shall not be delivered or used for planting while in a frozen or muddy condition. 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.

2. Onsite loam may be available from stripping of onsite topsoil. Onsite topsoil shall be tested as specified below and shall be amended as necessary to meet Specification requirements for loam.

3. Soil Analysis: The Contractor shall submit representative Samples of loam, which he intends to bring onto the Site, and Samples of loam from onsite sources, to a Soil and Plant Testing Laboratory acceptable to the Engineer. All reports shall be sent to the Engineer for approval. Samples of loam to be brought to the Site must be approved prior to delivery of soil. Deficiencies in the loam shall be corrected by the Contractor, as directed by the Engineer after review of the testing agency report by a soils consultant. Testing reports shall include the following tests and recommendations.

   a. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.

   b. The silt clay content shall be determined by a Hydrometer Test.

   c. Percent of organics shall be determined by an Ash Burn Test or Walkley/Black Test.

   d. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Soluble Salts, and acidity (pH).

   e. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish particular lawn and planting objectives noted.

   f. All tests shall be performed in accordance with the current standards of the Association of Official Agriculture Chemists.

4. Loam for General Lawn and Site Restoration Areas: Loam shall conform to the following grain size distribution for material passing the #10 sieve:

	Percent Passing	
U.S. Sieve Size Number	**Minimum**	**Maximum**
10	100	----
18	84	100
35	63	72
140	26	40
270	22	34
0.002 mm	2	5

[1]The ratio of the particle size for 80% passing (D_{80}) to the particle size for 30% passing (D_{30}) shall be 6 or less ($D_{80}/D_{30} < 6$).

[2]Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

[3]Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

[4]The organic content shall be between 4.0 and 6.0 percent.

5. Place a minimum of 4 inches of loam.

B. Typical Sand Amendment

1. Sand to be mixed with topsoil shall meet the following requirements. The material shall be uniformly graded coarse sand consisting of clean, inert, rounded grains of quartz or other durable rock and free from loam or clay, surface coatings, mica, other deleterious materials with the following gradation.

	Percent Passing	
U.S. Sieve Size Number	**Minimum**	**Maximum**
10	100	----
18	60	80
35	35	55
60	8	20
140	0	8
270	0	3
0.002 mm	0	0.3

[1]Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 10% by weight of the total sample.
[2]The ratio of the particle size for 70% passing (D_{70}) to the particle size for 20% passing (D_{30}) shall be 3.0 or less ($D_{70}/D_{20} < 3.0$).
[3]Tests shall be combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

C. 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.

D. Lime

1. Lime shall be an agricultural type ground limestone.

2. Lime shall be pelletized type for prolonged time release to soil.

3. Lime shall be applied at the rates recommended in the soil analysis.

E. Seed

1. Seed shall be of the previous year's crop.

2. Required properties:

   a. Purity > 90%
   b. Germination > 80%
   c. Crop < 0.5%
   d. Weed < 0.3%
   e. Noxious Weed – 0%
   f. Inert < 8%

3. Grass seed shall conform to the following mixtures in proportion by weight and weed content and shall pass the minimum percentages of purity and germination as indicated for same.

Natural Area Seed Mix	% Weight
Kentucky 31 Fescue	40%
Palmer Perennial Ryegrass	30%
Birds Foot Trefoil (Empire Variety)	15%
Red Clover	5%
White Clover	5%
Redtop (Streaker Variety)	5%

4. All seed shall comply with State and Federal seed Laws and Regulations.

F. 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 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.

3.2 PREPARATION

A. After rough grading of the subgrade has been completed and approved, the subgrade surface shall be scarified to a depth of four (4) inches. Then furnish and install a layer of loam providing a rolled four (4) inch thickness. Any depressions which may occur during rolling shall be filled with additional loam, regraded and rerolled until the surface

is true to the finished lines and grades. All loam necessary to complete the Work under this section shall be supplied by the Contractor.

B. The ground surface shall be fine graded and raked to prepare the surface of the loam for lime, fertilizer and seed.

C. The loam shall be prepared to receive seed by removing stones and grading to eliminate water pockets and irregularities prior to placing seed. Finish grading shall result in straight uniform grades and smooth, even surfaces without irregularities to low points.

D. All stones over one-half (½) inch in diameter remaining on the surface after raking shall be removed.

E. Shape the areas to the lines and grades required. The Contractor's attention is directed to the scheduling of Loaming and Seeding of graded areas to permit sufficient time for the stabilization of these areas.

F. All areas disturbed by construction within the property lines and not covered by structures, pavement, or bark mulch shall be loamed and seeded.

G. Limestone shall be thoroughly incorporated into the loam layer at a minimum rate of 3 ton per acre or more as recommended by the loam analysis in order to provide a pH value of 5.5 to 6.5.

H. Fertilizer shall be spread on the top layer of loam at the minimum rate of 500 pounds per acre or more as recommended by the loam analysis and worked into the surface

3.3 LOAM AND SEED AREAS

A. For temporary protection of disturbed areas, seed shall be applied at the following rates:

Winter Rye (fall seeding)	2.5 pounds per 1,000 square feet
Oats (spring seeding)	2.5 pounds per 1,000 square feet
Mulch	1.5 tons per acre

B. The seed mixtures shall be applied at a minimum rate of 200 pounds per acre, or 4.5 pounds per 1,000 square feet.

C. Athletic field seed application rates:

1. Kentucky Bluegrass – 130 pounds per acre

2. Perennial Ryegrass – 70 pounds per acre

D. Seed shall be sown at the rates indicated above by rotary or drop spreader. Sowing shall be done on a calm, dry day. Immediately before seeding, the soil shall be lightly raked. One half the seed shall be sown in one direction and the other half at right angles to the original direction. It shall be lightly raked into the soil to a depth not over 1/4 inch and rolled with a hand roller weighing not over 100 pounds per linear foot of width.

1. Straw mulch shall be applied immediately after seeding at a rate of 1.5 to 2 tons per acre. Mulch that blows or washes away shall be replaced immediately and anchored using appropriate techniques.

2. The surface shall be watered and kept moist with a fine spray as required, without eroding the soil, until the grass is well established. Any areas, which are not

satisfactorily covered with grass, shall be reseeded, and all noxious weeds shall be removed.

E. Unless otherwise approved, seeding shall be done between the periods from April 15th to June 1st, and August 15th to October 1st, when soil conditions and weather are suitable for such Work.

3.4 MAINTENANCE

A. Maintenance shall include watering, weeding, removal of stones and other foreign objects over one half (½) inch in diameter, cutting the grass until final acceptance. Mow at least weekly, removing no more than 30-40 percent of the leaf tissue using well sharpened blades. Mow grass between one (1) and two (2) inches high in the spring and fall. Mowing heights shall be an additional one-half to an inch in the summer to reduce temperature stress. Leave the clippings in place to help recycle essential plant nutrients needed for growth. All bare or dead spots which become apparent shall be properly prepared, re-loamed, limed, aerated, fertilized, and reseeded as many times as necessary to secure a good growth. The entire area shall be maintained, watered and cut until final acceptance of the lawn installation.

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.

C. To be acceptable, seeded areas shall consist of a uniform stand without bare or dead spots of at least 90 percent established permanent grass species, with uniform count of at least 200 plants per square foot.

D. The Engineer shall determine whether maintenance shall continue in any part.

E. After all necessary corrective Work and clean-up has been completed, and maintenance instructions have been received by the Owner, the Engineer will certify in writing the acceptance of the lawns.

F. Substantial Completion will not be achieved until the seeded areas have demonstrated a satisfactory stand of growth as determined by the Engineer. 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.

END OF SECTION

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SECTION 02955

CLEANING OF UNDERGROUND PIPING AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Removal of dirt, rocks, sand and other material within underground piping

2. Removal of dirt, rocks, sand and other material within underground structures

1.2 SUBMITTALS

A. Proposed cleaning procedures

B. Proposed cleaning equipment

1.3 QUALITY ASSURANCE

A. Contractor shall have at least 5 years experience cleaning underground piping and structures.

B. Contractor shall have successfully completed a minimum of 10 projects where piping and structures of similar size and condition to those on this project were cleaned.

C. Contractor shall have Confined Space Entry training.

PART 2 PRODUCTS

2.1 CLEANING EQUIPMENT

A. High-Velocity Jet (Hydrocleaning) Equipment

1. All high-velocity pipe cleaning equipment shall be constructed for ease and safety of operation.

2. The equipment shall have a selection of two or more high-velocity nozzles.

3. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned.

4. Equipment shall also include a high-velocity gun for washing and scouring structure walls and floors. The gun shall be capable of producing flows from a fine spray to a solid stream.

5. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

B. Mechanically Powered Equipment

1. Mechanically powered equipment includes power rodding machines, bucket machines and winches using root cutters and porcupines.

2. Machines shall be belt-operated or shall have an overload device.

3. Machines with direct drive that could cause damage to the pipe are not allowed.

4. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be made of heat-treated steel. The machine shall be fully enclosed and have an automatic safety clutch or relief valve.

C. Vacuum-Operated Equipment

D. Other cleaning equipment approved by the Engineer

2.2 WATER FOR SEWER CLEANING

A. Water is available to the Contractor from nearby Connecticut Water Company hydrants for pipeline cleaning and installation of the liner. Contractor to coordinate with Connecticut Water Company for access and operation of hydrants for taking water.

B. Payment for water shall be the responsibility of the Contractor.

PART 3 EXECUTION

3.1 CLEANING OF PIPES AND STRUCTURES

A. Clean new structures and piping installed on this contract and structures and piping listed on the Drawings by hand; by using hydraulically propelled, high-velocity jet; vacuum-operated equipment; mechanically powered equipment; or other methods/equipment approved by the Engineer. The methods used shall be capable of removing dirt, rocks, sand, roots, and other materials and obstructions from the piping and structures.

B. If cleaning of an entire pipe length cannot be completed from one end, set up the equipment at the other end of the pipe and then again attempt to clean the pipe section.

C. Restore pipes to a minimum of 95% of their original hydraulic capacity.

D. Remove and dispose of all dirt, rocks, sand, roots, and other materials within the structures and piping to be cleaned.

E. During pipe cleaning operations, take precautions in the use of equipment to prevent damage to public and private property.

F. When hydraulically propelled cleaning tools or flows which retard the flow in the pipe are used, take precautions to insure that the water pressure created does not cause damage or flooding of public or private property. When possible, use the flow in the pipe to provide the necessary pressure for hydraulic cleaning devices. When additional water from hydrants is necessary, conserve water and do not use unnecessarily.

G. Contractor shall safely and legally provide for off-site disposal of all materials and debris removed from the pipe and structures.

END OF SECTION

SECTION 02958

TELEVISION INSPECTION OF PIPELINES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Closed-circuit television (CCTV) inspection of pipelines

1.2 SUBMITTALS

A. Manufacturer's product data for the television inspection equipment, including camera, television monitor, carriage, recording device, signal conductor cable, etc.

B. Information on database/software that will be used to store and review inspection data.

C. Sample of television inspection log that will be used. Provide a legend for all abbreviations, symbols, codes, etc. used on the logs.

D. Documentation submittals

1. Two printed copies of the television inspection reports, provided weekly during the course of the CCTV inspection work.

2. Two copies of the television inspection video and voice audio recordings saved onto CD-R/RW or DVD-R media, provided weekly during the course of the CCTV inspection work. The electronic file names must be labeled to identify the sewer segment televised by street and upstream and downstream manholes (for example "Washington Avenue SMH 1 – SMH 2").

1.3 QUALITY ASSURANCE

A. Personnel shall have confined space entry and other training as appropriate for the work to be performed.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Provide all equipment necessary to complete the video inspections with voice audio recordings, including, but not limited to, inspection studio, television camera, and video capture equipment.

B. The inspection equipment shall be capable of inspecting a minimum of 700 feet of pipe where entry into the pipe can only be made from one end. The equipment shall be capable of providing a picture of acceptable quality at these maximum lengths, regardless of the vibration caused by normal movement of the camera and the length of the signal conductor cable between the camera and the recording device.

C. The inspection equipment shall be capable of clearly televising the interior of a six inch diameter pipe and all larger sizes.

D. The television camera used for the inspection shall be one specifically designed and constructed for such inspection.

E. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe.

F. The camera shall be waterproof and operative in 100% humidity conditions.

G. The camera, television monitor, and other components of the video system shall be capable of producing a high quality color image with clear definition of pipe internal features.

H. A pan and tilt camera shall be used for the television inspection to provide the ability to view into the laterals to determine the accessibility of the lateral by the lateral inspection system (LIS) camera.

I. The pan and tilt camera shall be capable of 360 degree rotational scan. The tilt arc shall not be less than 225 degrees and the viewing angle shall be a minimum of 300 degrees. The lens position shall be operated remotely. Cameras incorporating mirrors for viewing sides or cameras using exposed rotating heads are not acceptable.

J. The camera shall be an auto-iris type with remote controlled manual override. The adjustment of focus and iris shall provide a minimum focal range of from 6 inches in front of the camera lens to infinity.

K. The distance along the pipe in focus from the initial point of observation shall be a minimum of twice the vertical height of the pipe.

L. The illumination must be such as to allow an even distribution of light, which will produce a clear picture around the pipe perimeter, regardless of diameter and without the loss of contrast, flare out of picture, or shadowing. The lighting system shall also minimize reflective glare and the intensity shall be fully adjustable. The camera lighthead shall include a high-intensity side viewing lighting system to allow illumination of internal sections of lateral pipe connections.

M. The television studio shall be insulated against noise and extremes in temperature and shall be large enough for two people for the purpose of viewing the television monitor while the inspection is in progress. The television studio shall be mounted on a mobile vehicle which allows safe and orderly movement of the inspection equipment.

N. The television monitor screen shall be not less than 17 inches, measured on the diagonal.

O. The television camera, monitor, and other components of the video system shall be capable of receiving and transmitting a picture having not less than 500 lines of resolution.

P. The camera shall be mounted on a self-propelled vehicle or skid assembly that is able to ride over obstructions and cushion the camera against shock. The skid shall also have guards to keep the camera in line in the event of a turnover due to an obstruction.

Q. The television inspection equipment shall meet the following criteria:

1. Color: The following colors shall be clearly differentiated: white, yellow, cyan, green, red, blue, and black.

2. Linearity: The background grid shall show squares of equal size, without convergence or divergence over the whole picture. The center circle shall appear round and have the correct height and width relationship.

3. Resolution: The live picture shall be displayed on a monitor capable of providing a clear, stable image free of electrical interference with a minimum horizontal resolution not less than 500 lines.

4. Color Consistency: To ensure that the camera shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the survey. In order to ensure color consistency, generally no variation in illumination shall take place during the survey.

R. The monitor display shall incorporate an automatically updated record in feet and tenths of a foot of the distance along the pipe from the cable calibration point to the center point of the camera. Use a suitable metering device which enables the length of the pipe being inspected to be accurately measured to within ±0.2 feet.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean sewers to be video-inspected in accordance with Section 02955.

B. Reduce flow level in pipe being inspected by bypass pumping or by jetting to meet the requirements described below, unless otherwise agreed to:

Maximum Depth of Flow for Television Inspection

6 inch to 10 inch pipe	20% of pipe diameter
12 inch to 24 inch pipe	25% of pipe diameter
Greater than 24 inch pipe	30% of pipe diameter

C. Alternatively, perform television inspection during off-peak hours when flow depths are lower.

3.2 INSPECTION

A. Television all new and replacement sewer lines.

B. Move the camera through the pipe at a moderate rate, stopping where necessary to permit proper documentation of all pertinent features/defects. In no case will the television camera be pulled at a speed greater than 30 feet per minute.

C. Use manual winches, power winches, TV cable, powered rewinds or other devices to move the camera through the pipe that do not obstruct the camera view or interfere with proper documentation of the pipe conditions. All winches shall be stable with either locking or ratcheting drums.

D. If, during the inspection operation, the television camera will not pass through the entire pipe section from one direction, set up equipment so that the inspection can be performed from the opposite direction, if possible.

E. When manually operated winches are used to pull the television camera through the pipe, use portable radios, telephones or other suitable means of communication between members of the crew located at each end of the pipe section being inspected to insure good communications.

F. The importance of accurate distance measurements is emphasized. Measurement for location of pipe features/defects shall be by means of a meter device. Marking on the

cable or a similar method will not be allowed. Accuracy of the distance meter shall be checked by use of a measuring wheel, tape, or other suitable distance measuring device.

G. Record the following pipe features/defects, at a minimum, and report them on the inspection logs in accordance with National Association of Sewer Service Companies (NASSCO) developed Pipeline Assessment Certification Program (PACP) methodology:

1. Pipe diameter and material of construction.

2. Joint spacing and the location of joints which appear to be damaged, incorrectly installed, shifted, open, or in any way deficient.

3. Location, size and orientation (clock position) of connecting pipes (such as building services in a sewer).

4. Description of severity and location of pipe structural deficiencies such as cracks, breaks, collapses, corrosion/erosion, etc.

5. Description of severity and location of pipe obstructions (such as sediment, roots or grease).

6. Description of severity and location of grade concerns, such as pipe sags, especially in gravity pipes.

7. The locations where infiltration is entering the pipe and/or connecting pipes and an estimated infiltration rate at each location.

H. Position the camera at the location of connecting pipes, and pan/tilt appropriately in order to obtain a clear view of the interior of the connecting pipe. Make note of any defects or infiltration visible within the connecting pipes.

I. Indicate direction of survey and distance to each feature/defect from the beginning of the inspection.

J. Provide an audio description of each feature/defect observed.

K. Report on the logs weather conditions, ground conditions, and surface cover.

L. Repair pipe damaged as a result of the inspections at no cost to the Owner.

M. Position camera head to reduce risk of picture distortion and along the longitudinal axis of the pipe. In circular pipes, position camera lens centrally, ±10% of the vertical sewer dimension. In non-circular pipes, position camera lens at mid-height and centered horizontally.

3.3 DOCUMENTATION

A. Television Inspection Logs

1. Prepare television inspection logs describing features/defects identified and their locations.

B. Video Recordings

1. Provide continuous digital video recordings of the inspection view as it appears on the television monitor. The image recorded shall be equal to or better than the quality of the original picture on the television monitor.

2. Provide a visual and voice audio description record of the pipe features/defects observed recorded simultaneously as original live recordings.

3. The audio portion of the recording shall be sufficiently free of electrical interference and background noise to produce an oral report that is clear, complete, and easily discernable. The audio portion of the video report shall include the location and identification of the pipe section inspected, the direction of travel, a description of the features/defects encountered, and the distance traveled.

4. Provide digitally formatted television inspection video/audio recordings saved onto CD-R/WR or DVD-R media with individual digital files for each recording completed. CDs and DVDs shall be properly identified by video numbers, locations, and project name.

5. Video recordings shall, by electronic means, display continuously and simultaneously generated transparent digital information as described below:

    a. At the start of each pipe section inspected:

        1) Size and length of pipe and pipe material

        2) Pipe section reference number

        3) Date of inspection

        4) Road name/location (city/town)

        5) Direction of inspection (upstream or downstream)

        6) Starting time of inspection

    b. Continuously during the inspection:

        1) Automatic update of the camera's position, in feet and tenths of feet from the beginning of the pipe section

        2) Upstream and downstream locations (manholes reference numbers for sewers and drains).

END OF SECTION

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SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Wood Form Material
2. Prefabricated Forms
3. Formwork Accessories
4. Vapor Barrier for Concrete Slab-on-Grade Construction

B. Related Sections

1. Section 03300 - Cast-in-Place Concrete
2. Section 03200 – Concrete reinforcement

1.2 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 301 - Specifications for Structural Concrete for Buildings
2. ACI 318 - Building Code Requirements for Reinforced Concrete
3. ACI 347 - Guide to Formwork for Concrete

B. American Society for Testing and Materials (ASTM)

1. D4 - Standard Test Method for Bitumen Content
2. D6 - Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds
3. D71 - Standard Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)
4. D217 - Standard Test Method for Cone Penetration of Lubricating Grease
5. D1056 - Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
6. D1751 - Standard Specifications for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
7. D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
8. D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

C. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing

D. National Institute of Standards and Technology (NIST)

1. Voluntary Product Standard PS 1-95 - Construction and Industrial Plywood

1.3 SUBMITTALS

A. Drawings showing schedule of placement, location of all construction joints and all control joints with methods of forming. Show the location and elevation of all sleeves, wall pipes and embedded items.

B. Drawings showing sizes and materials for forms, form bracing, and form ties.

C. Product Data on form release agent, permanent formwork and inserts.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: Class I High Density Overlay plyform, exterior grade, not less than 5 ply nor less than 5/8 inches thick conforming to Voluntary Product Standard PS 1-95

B. Lumber: Douglas Fir species, No. 1 grade S4S with grade stamp clearly visible

2.2 PREFABRICATED FORMS

A. Manufacturers:

1. Symons Corporation, DesPlains, Illinois

2. HICO Corporation, Bronx, NY

3. Or equal

B. Preformed Steel Forms: Minimum 16 gage (1.5 mm), tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearances of finished concrete surfaces; with clean, warp free, undented, ungouged, undamaged surfaces

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearances of finished concrete surfaces

2.3 FORMWORK ACCESSORIES

A. Form Ties:

1. Ties for foundation walls shall be metal and designed with removable setback cones so that after removal of the projecting part, no metal shall remain within 1½ inches of the face of the concrete.

2. Flat bar snap ties for panel forms shall have plastic or rubber inserts with 1½ inch minimum depth to allow patching of tie hole after removal.

3. Setback cones shall be wood or plastic tapered cones 1 inch diameter and 1½ inches deep to allow filling and patching of the concrete surface after removal.

4. Common wire ties shall not be used.

B. Form Release Agent:

1. Form release agent for potable water tanks and structures shall be vegetable oil based and shall be NSF approved for use with potable water.

C. Corners:

1. Chamfered No. 1 Poplar wood strips; ¾ inch by ¾ inch; maximum possible lengths

D. Premolded Joint Filler:

1. Buildings and Structures: Self-expanding cork, ASTM D1752, Type III; and Federal Specification HH-F-341-F, Type II, Class C; capable of one directional swelling up to 140% of its original thickness

2. Sidewalks: Asphalt impregnated, ASTM D1751, ¾ inch thick unless otherwise shown on the Drawings

E. Vapor Barrier:

1. 10 mils thick polyethylene sheeting conforming to ASTM D4397

PART 3 EXECUTION

3.1 GENERAL

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

B. Review all work prepared by others to receive work of this Section and correct any defects affecting installation. Commencement of work by the Contractor will be construed as complete acceptance of preparatory work by others.

C. Handle and store materials separately in such manner as to prevent intrusion of foreign matter, segregation, or deterioration. Do not use foreign materials or those containing frozen material. Remove improper and rejected materials immediately from point of use. Cover materials and accessories during construction period.

3.2 VAPOR BARRIER

A. Except where membrane waterproofing is required, all interior concrete slabs-on-grade shall be placed on a continuous vapor barrier.

1. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for the concrete slab.

2. Vapor barrier joints shall be lapped 6 inches and sealed with compatible waterproof pressure-sensitive tape.

3. Patch all punctures and tears.

3.3 EARTH FORMS

A. Earth forms are not permitted.

3.4 FORM PREPARATION

A. Coat contact surfaces of forms with a form release agent prior to form installation.

B. Thoroughly clean steel forms between uses using high pressure water or jet or sand blasting to remove all mill scale, concrete laitance or other ferrous deposits from the contact surfaces of the forms.

C. Before re-use of wood forms, thoroughly clean form contact surfaces, repair damaged areas and remove projecting nails. A partial or complete steel lining on wood sheathing or plywood will not be allowed.

3.5 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements of ACI 301 and the following additional requirements:

1. Variation from plumb in the lines and surfaces of columns, piers, and in walls

a. In any 10 feet of length ¼ inch

b. Maximum for entire length ½ inch

2. Variation of the linear building lines from established position in plan and related positions of columns, walls and partitions:

a. In any bay ¼ inch

b. In any 20 foot of length ¼ inch

c. Maximum for the entire length ½ inch

3. Variation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:

a. Minus $^{1}/_{8}$ inch

b. Plus ¼ inch

3.6 JOINTS

A. Construction and expansion joints indicated on the Drawings are mandatory and shall not be omitted.

B. Use premolded joint filler at expansion joints unless otherwise noted.

C. Form construction and expansion joints with a keyway and waterstop unless otherwise shown on the Drawings. The depth of the keyway shall be approximately 3 inches, and the minimum width of keyway shall be one-third the width of the wall or floor section unless otherwise shown on the Drawings. The maximum width of any key at a joint with waterstop shall be 3 inches. Construction and expansion joints are to be formed in place prior to notifying the Engineer for inspection of formwork.

D. Where joints other than those shown are required, obtain approval prior to installation.

E. Joints shall be straight and true. Brace all slab bulkheads adequately to keep joints straight. Construction joints in slabs exceeding 5 inches in thickness shall be keyed using a keyway nominally 3-5/8 inches by 1/3 of the slab thickness but not greater than 3 inches wide.

F. Wall construction joints shall be placed as shown on the Drawings, or the maximum spacing of vertical construction joints in walls shall not exceed 40 feet where construction joints are not shown.

G. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of the Engineer.

3.7 INSERTS, EMBEDDED ITEMS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work in conformance with requirements of ACI 318, paragraph 6.3, "Conduits and pipes embedded in concrete."

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, wall pipes, anchor bolts and other inserts. Wall pipes and sleeves shall conform to the requirements of Section 15050.

D. Install accessories in accordance with manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed or damaged during placement of concrete.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at the bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms and neatly fitted so that joints will not be apparent in exposed concrete surfaces after concrete placement.

3.8 ACCESSORIES

A. Position metal fabrications accessories and inserts supplied under Sections 05500 as specified therein and shown on the Drawings.

3.9 FORM REMOVAL

A. The Contractor shall be responsible for damage resulting from form removal. Forms and shoring for structural slabs or beams shall remain in place in accordance with requirements in ACI 301. Form removal shall also conform to the requirements specified in Section 03300.

3.10 INSPECTION

A. The Engineer shall be notified when the forms are complete and ready for inspection at least thirty-six hours prior to the proposed concrete placement.

B. Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with requirements of these Specifications, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of these Specifications and approval of the Engineer.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Reinforcing Steel Bars
2. Welded Wire Fabric
3. Reinforcing Accessories

B. Related Sections

1. Section 03100 - Concrete Forms and Accessories
2. Section 03300 - Cast-in-Place Concrete

1.2 REFERENCES

A. The Connecticut State Building Code, latest edition.

B. American Concrete Institute (ACI)

1. ACI 117 - Standard Tolerance for Concrete Construction and Materials
2. ACI 301 - Specifications for Structural Concrete for Buildings
3. ACI 315 - Details and Detailing of Concrete Reinforcement
4. ACI 318 - Building Code Requirements for Reinforced Concrete, American Concrete Institute
5. ACI 350R - Environmental Engineering Concrete Structures
6. ACI SP-66 - Detailing Manual

C. American Society for Testing and Materials (ASTM)

1. A185 - Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. A615 - Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
3. A675 - Specifications for Steel Bars, Carbon, Hot Wrought, Special Quality, Mechanical Properties

D. American Welding Society (AWS)

1. D1.4 Structural Welding Code - Reinforcing Steel

E. Concrete Reinforcing Steel Institute (CRSI)

1. CRSI 63 - Recommended Practice for Placing Reinforcing Bars

2. CRSI 65 - Recommended Practice for Placing Bar Supports, specifications and nomenclature

1.3 SUBMITTALS

A. Provide shop drawings in accordance with the recommendations of ACI 315, "Details and Detailing of Concrete Reinforcement" and show the following: elevations, dimensions of concrete work with specified reinforcement clearances; ledges, brackets, openings, sleeves or other items furnished by other Sections, where interference with reinforcement may occur; bending diagrams; assembly diagrams; splices and laps of reinforcement; temperature and shrinkage reinforcement; construction joint reinforcement and shape; dimensions, grade designations, and details of reinforcement and accessories. Show dowels with concrete work to be placed first. Shop drawings shall be drawn to scale.

B. Bar Bending Details - The bars shall be referenced to the same identification marks shown on the placement drawings. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.

C. Prior to delivery of reinforcing steel or concrete to job site, submit certified mill test reports of reinforcing steel and cement (including names and locations of mills and shops, and analyses of chemical and physical properties), properly correlated to concrete to be used in this project.

1.4 DELIVERY, HANDLING AND STORAGE

A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

B. Reinforcing steel shall be covered and stored off the ground, protected from moisture, and kept free from dirt, oil, or other foreign matter.

PART 2 PRODUCTS

2.1 REINFORCING STEEL BARS

A. Reinforcing steel bars shall be newly rolled billet steel conforming to ASTM A615, Grade 60.

B. Minimum yield strength shall be 60,000 psi.

C. Where reinforcing steel bars are called for to be grouted into existing concrete, the anchorage shall develop an allowable bond strength equal to 24,000 psi times the cross section area of the bar, or an ultimate strength equal to the tensile strength of the bar.

1. For installations in non-submerged concrete with an ambient temperature greater than or equal to 40 degrees Fahrenheit, the epoxy adhesive shall be, Hilti HIT_HY 200, Simpson SET-XP, Powers PE 1000+ or approved equal.

2. For installation in wet or submerged concrete with an ambient temperature greater than or equal to 40 degrees Fahrenheit, the epoxy adhesive shall be Hilti HIT RE-500SD, Simpson ET-HP, Powers Pure 110+ or approved equal.

3. For installation in concrete below 45 degrees Fahrenheit the epoxy adhesive shall be Hilti HIT ICE, Simpson AT-XP or equal.

2.2 WELDED WIRE FABRIC

A. Welded wire fabric shall conform to ASTM A185

2.3 REINFORCEMENT ACCESSORIES

A. Reinforcement accessories shall conform to Product Standard PS7-766, National Bureau of Standards, Department of commerce, Class C, as produced by Dayton Superior Corporation; R.K.L. Building Specialties Co., Inc. or equal approved by the Engineer.

B. Reinforcement accessories shall include spacers, chair ties, slab bolsters, clips, chair bars, and other devices for properly assembling, placing, spacing, supporting, and fastening reinforcement.

C. Tie wire shall be of sufficient strength for all intended purpose, but not less than No. 18 gauge. Metal supports shall be of such type as not to penetrate surface of formwork and show through surface of concrete.

D. Accessories touching interior formed surfaces exposed to view shall have not less than 1/8 inch of plastic between metal and concrete surface. Plastic tips shall extend not less than 1/2 inch up on metal legs.

E. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 pound load without damage or permanent distortion.

PART 3 EXECUTION

3.1 EXAMINATION

A. Review all work prepared by others to receive work of this Section. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.2 PREPARATION

A. Notify the Engineer prior to the start of any phase of the reinforcing work so as to provide the opportunity to inspect the work. Such notification shall be made at least 24 hours in advance of reinforcement placements and at least 36 hours in advance of other inspections (forms, etc.).

3.3 REINFORCING BAR FABRICATION

A. Fabrication of reinforcement shall be in accordance with the recommendations of CRSI.

B. Reinforcing bars shall be cold bent and shall not be straightened or re-bent. Bars shall not be field bent unless approved by the Engineer.

C. Reinforcing bars shall be bent around a revolving collar having a diameter of not less than that recommended by the CRSI.

D. Reinforcing bar ends that are to be butt spliced or threaded, shall have the applicable end saw-cut. Such ends shall terminate in flat surfaces at a right angle to the axis of the bar.

E. Where reinforcing bars are called for to be welded, the welding shall conform to AWS D1.4 Structural Welding Code - Reinforcing Steel.

3.4 INSTALLATION

A. Reinforcement shall be placed in accordance with requirements of CRSI -63 - "Recommended Practice for Placing Reinforcing Bars" and CRSI 65, "Recommended Practice for Placing Bar Supports" and with further requirements below.

B. Reinforcement shall be accurately placed in accordance with Contract Documents and shall be firmly secured in position by wire ties, chairs, spacers, and hangers, each of type approved by the Engineer. For slabs, grade beams, etc. where concrete is poured on grade, use additional setup bars and concrete brick to provide required cover over reinforcement.

C. Bending, welding or cutting reinforcement in field in any manner other than as shown on Drawings, is prohibited, unless specific approval for each case is given by the Engineer.

D. Reinforcement shall be continuous through construction joints unless otherwise indicated on Drawings.

E. Reinforcement shall be spliced only in accordance with requirements of Contract Documents or as otherwise specifically approved. Splices of reinforcement at points of maximum stress shall generally be avoided.

F. Welded wire fabric shall lap 6 inches or one space plus 2 inches whichever is larger, and shall be wired together. Provide No. 4 set up bars spaced 30 inches on center for slabs-on-grade or elevated slabs with composite decks.

G. Proceed with installation of embedded items, and reinforcement, but do not place concrete into or around such items until the Engineer has approved work.

3.5 FIELD QUALITY CONTROL

A. The Engineer shall have the right to postpone or stop concrete operations when in his judgment, reinforcement and embedded item installation has not been properly completed or the quality of construction will impair strength and durability or desired finished product. Costs arising from delays due to noncompliance will not be considered.

B. Any material or workmanship that is rejected, either at the batch plant or at the site, shall be replaced promptly at no additional cost to the Owner.

C. Before concrete is placed, reinforcement shall be free of excessive rust, dirt, oil, scale or other foreign matter that will destroy or reduce bond requirements. Reinforcement expected to be exposed to weather for a considerable length of time shall be painted with a heavy coat of cement grout. Protect stored materials so as not to bend or distort bars in any way. Bars that become damaged will be rejected.

D. Before concrete is placed, check all installed reinforcement to ensure that it conforms to Contract Documents and approved Shop Drawings. Such checking shall be done only by qualified experienced personnel. In addition, the Engineer shall be notified at least 36 hours prior to concrete placement and given opportunity to inspect completed reinforcement. Prior approval of Shop Drawings shall in no way limit the Engineer's right to require modifications or additions to reinforcement or accessories.

E. Expansion joint dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inches on the diameter of the dowel and extends no more than 0.04 inches from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end.

3.6 ADJUSTING

A. Carry out corrections without delay as directed by the Engineer when construction operations indicate that requirements of Contract Documents or prudent construction practices are being or are about to be violated.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Concrete Materials
2. Admixtures
3. Concrete Mix
4. Miscellaneous Concrete Materials

B. RELATED SECTIONS

1. Section 03100 - Concrete Forms and Accessories
2. Section 03200 – Concrete Reinforcement

1.2 REFERENCES

A. The Connecticut State Building Code, latest edition

B. American Concrete Institute (ACI)

1. ACI 301-95 - Specifications for Structural Concrete for Buildings, (included as part of this specification)
2. ACI 305 - Hot Weather Concreting
3. ACI 306.1-90 - Standard Specifications for Cold Weather Concreting
4. ACI 318-14 - Building Code Requirements for Reinforced Concrete", American Concrete Institute

C. American Society for Testing and Materials (ASTM)

1. C33 – Standard Specification for Concrete Aggregates
2. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
3. C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
4. C42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5. C87 - Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
6. C94 - Standard Specification for Ready-Mixed Concrete
7. C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

8. C150 – Standard Specification for Portland Cement
9. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
10. C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
11. C494 - Standard Specification for Chemical Admixtures for Concrete
12. C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
13. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
14. C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
15. C881 – Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete
16. C989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
17. C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete

1.3 SUBMITTALS

A. Submit concrete mix proposed for use, indicating design strength, supplier, batch quantities, and constituents. Provide test report copies indicating prior satisfactory performance in accordance with ACI 301.

B. Submit data and descriptive literature for concrete constituents including admixtures, aggregate tests, bond breaker, bonding agent, and repair grout.

C. Submit detailed methods proposed for curing and protection of concrete. This submittal shall be made not less than 10 days prior to the placement of any concrete.

D. Submit a truck load ticket for every concrete delivery. Ticket information shall include batch time and date, weights of all constituents, quantity of admixtures, water added at the batch plant and moisture content of coarse and fine aggregates.

E. Maintain an accurate daily record of the locations and quantity of concrete placed.

1.4 QUALITY ASSURANCE

A. Inspection of cast-in-place concrete work, and testing, including slump tests, air content, and standard compression test cylinders will be performed by the Engineer. Materials and workmanship shall be subjected to inspection and testing in mill, shop and/or field by the Engineer. Such inspection and testing shall not relieve Contractor of his responsibility to provide his own inspection, testing, and quality control as necessary to furnish materials and workmanship in accordance with requirements of this Section.

B. Provide notification prior to the start of any phase of concrete placement work so as to provide the opportunity to inspect the work. Such notification shall be made at least 24 hours in advance of concrete placements and at least 36 hours in advance of other inspections (forms, rebar, etc.).

C. Facilitate inspection and testing by the Engineer, and furnish the following:

1. Safe access to the work at all times to allow proper inspection of the work

2. Full and ample means and assistance for sampling and testing materials and proper facilities for inspection of work in plant and at project site

3. Covered box large enough to contain twenty-four standard concrete cylinders. At temperatures below 60°F, box shall be electrically heated and thermostatically controlled to maintain inside temperature of 60º to 80°F. Cylinders shall be placed in box immediately after molding and shall be covered with moist burlap until delivery to laboratory, 24 to 72 hours after molding.

4. Access by the Engineer or his representative to the batch plant supplying the concrete at any time.

D. Compression tests shall consist of one set of 4 cylinders for each test made, cured, and tested by testing laboratories during progress of job. 6 cylinders shall be required for each test made with concrete mix containing fly ash or ground granulated blast furnace slag. One set of cylinders shall be taken for every 100 cubic yards of concrete or fraction thereof placed in any one day.

1. 1 cylinder of each set shall be tested for 7-day compressive strength; 2 cylinders shall be tested for 28-day compressive strength. The remaining cylinder shall be tested for 56-day compressive strength if either one of the 28-day tests are below the specified strength, otherwise the 56-day test will be eliminated.

2. For modified mix with fly ash or ground granulated blast furnace slag, 1 cylinder of each set shall be tested for 7-day compressive strength, 2 cylinders shall be tested for 28-day compressive strength and 2 cylinders shall be tested for 56-days compressive strength. The remaining cylinder shall be tested for 84-day compressive strength if either one of the 56-day tests are below the specified strength, otherwise the 84-day test will be eliminated.

3. The Owner will provide and pay for the services of an approved testing laboratory to test the cylinders. Compression strength test of cylinders shall conform to ASTM C39, latest revision. The cost of all testing work under this Section will be borne by the Owner. The testing laboratory will submit certified copies of the test results directly to the Engineer and the Owner within 24 hours after tests are made.

4. Sampling, molding, curing and testing of cylinders shall conform to ASTM requirements. Specimens shall be cured under laboratory conditions. The Engineer may require additional cylinders to be cured under field conditions when unusual conditions may tend to reduce concrete strength.

5. Report of tests shall include: name of project, date and location of concrete placement, design strength of concrete, mix data, slump, air content (if tested), compressive strength, age and condition of test cylinder, type of fracture, and type of curing.

E. Slump test, to check consistency, shall be made from the sample used to mold cylinders. Additional slump tests may be taken of every batch delivered to job site.

F. Tests for determination of air content shall be made as required to verify conformance with the specifications.

G. The strength level of the concrete mix shall be considered satisfactory if both of the following criteria are satisfied:

1. Every arithmetic average of any three consecutive strength tests equals or exceeds the specified design strength.

2. No individual strength test (average of two cylinders from the same test group) falls below the specified design strength by more than 500 psi when the specified design strength is 5000 psi or less or by more that 10 percent of the specified design strength when the design strength is more than 5000 psi.

H. When tests of control specimens fall below these requirements, the Engineer will require 56 day or 84 day cylinder tests or core specimens taken from concrete in question and tested in accordance with ASTM C42. If these specimens do not meet strength requirements, the Engineer has the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to ensure safety, appearance, and durability of structure. Additional testing, load tests, strengthening or removal and replacement of parts or structure and any costs associated with delay of project shall be at no additional cost to the Owner.

I. Any material or workmanship which is rejected, either at the batch plant or at the site, shall be replaced promptly at no additional cost to the Owner.

J. If arrangements for corrections and/or replacements are not made within seven days after notice of rejection, the Owner has the right to have corrections and/or replacement made and charge cost thereof and any costs associated with delay of project against balance of monies withheld.

K. Acceptance of work and admixtures at the batch plant shall not prevent final rejection at job site upon arrival or after it has been installed, if work is found to be defective.

L. Portions of a structure which do not meet the requirements of the Contract Documents based on appearance or for any other aesthetic reason, shall be corrected or removed and replaced at no additional cost to the Owner.

M. Work on new concrete structures shall conform to the requirements of ACI 306.1, Standard Specifications for Cold Weather Concreting, except as modified herein.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: shall be American-made Portland Cement, free from water soluble salts or alkalies which will cause efflorescence on exposed surfaces. Portland Cement shall be Type II, ASTM C150. Air entraining cements are prohibited.

B. Pozzolans and Blast Furnace Slag

1. Fly Ash: Class F conforming to the requirements of ASTM C618.

2. Ground Granulated Iron Blast-Furnace Slag: Conforming to ASTM C989.

C. Normal weight Fine Aggregate

1. Washed, inert, natural sand conforming to ASTM C33 and the following additional requirements.

a. Fineness Modulus 2.75 (plus/minus 0.25)

b. Clay lumps and friable particles – 3.0 percent maximum

c. Coal and lignite – 0.5 percent maximum

d. Organic Impurities (ASTM C40) – Organic Plate No. 2

e. Strength of Mortar (ASTM C87) – not less than 95 percent at 7 days

f. Soundness (AASHTO T-104) - 10 percent maximum loss (magnesium sulfate solution, five cycles)

D. Normal weight Coarse Aggregate

1. Well graded crushed stone or washed gravel conforming to ASTM C33 and the following additional requirements:

a. Material finer than No. 200 sieve – 1.0 percent maximum

b. Clay lumps and friable particles – 2.0 percent maximum

c. Chert (less than 2.40 specific gravity, saturated surface dry) – 3.0 percent maximum by weight.

d. Sum of clay lumps, friable particles, and chert (less than 2.40 specific gravity, saturated surface dry) – 3.0 percent maximum by weight. This limitation only applies to aggregates in which chert appears as an impurity.

e. Coal and lignite – 0.5 percent maximum

f. Soundness - 18 percent maximum loss (magnesium sulfate solution, five cycles)

g. Soundness - 10 percent maximum loss (sodium sulfate solution, five cycles)

2. Coarse aggregates shall not exceed 35% by weight "percentage of wear" as determined by the Los Angeles Abrasion and Impact Tests in ASTM C131 and C535.

E. Water shall be from approved source, potable, clean and free from oils, acids, alkali, organic matter and other deleterious material.

2.2 ADMIXTURES

A. Water-reducing agent:

1. Water-reducing agent shall be by same manufacturer as air-entraining agent.

2. Daracem - 55 W.R. Grace & Co.

3. Pozzolith 220N – BASF Admixtures, Inc.

4. Eucon MR - Euclid Chemical Co.

5. Or equal conforming to ASTM C494 Type A.

B. Air-entraining agent:

1. DAREX AEA - W.R. Grace & Co.

2. MB-VR or MB-AE90 - BASF Admixtures, Inc.

3. Air-Mix - Euclid Chemical Co.

4. Or equal conforming to ASTM C260.

C. Admixtures which retard setting of cement in concrete shall not be used without written approval of the Engineer. Admixtures causing accelerated setting of cement in concrete shall not be used.

2.3 CONCRETE MIX

A. Select proportions of ingredients to meet the design strength and materials limits specified and to produce concrete having proper placability, durability, strength, appearance and other required properties. Proportioning shall also conform to the requirements in ACI 301 and ACI 318.

B. The concrete mix design shall be a 4500 psi compressive strength concrete using ¾ inch aggregate. The design mix shall be selected based on previous test records for a mix with essentially the same proportions, and shall meet the following limiting values in Table A:

TABLE A
Maximum Allowable Water/Cement Ratios

Minimum Allowable 28 day Compressive Strength (psi)	Maximum Allowable Water/Cement Ratio	Total Cementitious Material (Pounds)	
		Min	Max
4500	0.45	635	658

C. If sufficient test records are not available, (at least 30 consecutive strength tests or two groups of tests totaling at least 30 within the past 12 months), the design mix shall be developed using laboratory trial mixtures in accordance with ACI 301.

D. All concrete is normal weight with air-dry weight not to exceed 150 lbs. per cubic foot.

E. Fly ash may be substituted for up to 20 percent by weight of the total cementitious material. Ground granulated iron blast-furnace slag may be substituted for up to 40 percent by weight of the total cementitious material.

F. For concrete flatwork with a steel trowel finish, fly ash may be substituted for up to 10 percent by weight and ground granulated iron blast-furnace slag may be substituted for up to 25 percent by weight of the total cementitious material.

G. All concrete shall contain the approved air-entraining admixture as per manufacturer's written instructions to provide entrained air by volume in the cured concrete between 4.5 and 7.5%.

H. The design mix shall meet the following slump limiting values in Table B:

TABLE B
Concrete Slump[1]

Portion of Structure	Recommended (inches)	Maximum Range (inches)

Mats	2	2-3
Walls, Column, Beams	4	3-5
Slabs	3	2-4

[1]After addition of high range water reducer

I. The approved water-reducing admixture shall be used in all concrete, in accordance with manufacturer's written instructions.

2.4 MISCELLANEOUS MATERIALS

A. Grout shall be a ready-to-use, non-metallic, non-shrink aggregate product requiring only the addition of water at the job site. Grout shall be as manufactured by Five Star Products, Inc.; Euclid Chemical Company; Master Builders; or equal. Grout shall be easily workable and shall have no drying shrinkage at any age. Compressive strength of grout (2 inch by 2 inch cubes) shall not be less than 5000 psi at 7 days, and 7500 psi at 28 days.

B. Floor Hardener, Sealer, and Waterproofing Treatment:

1. Concrete floor surfaces not covered with resilient flooring or carpet shall receive a surface treatment after steel trowel finishing.

2. Product and Manufacturer:

a. Ashford Formula hardener and sealer as manufactured by Concrete Chemical Company, Inc., Springville, Utah

b. Seal Hard concrete sealer as manufactured by L&M Construction Chemicals, Inc., Omaha, Nebraska

c. Approved equal

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify cover requirements over all reinforcement.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

C. Verify site conditions to insure that full access is available for placement of concrete.

3.2 JOINTS

A. Construction and expansion joints indicated on Drawings are mandatory and shall not be omitted. Construction joints shall conform to the requirements of Section 03100 and the following:

1. Before placing new concrete against concrete already in place and hardened, the surface shall again be cleaned with a jet where practical. The exposed aggregate shall then be mopped with a mortar composed of the same proportions of sand and placed and mopped in place immediately prior to the placing of concrete and shall not have set up or hardened prior to the placing of concrete.

2. Where joints other than those shown are required, they shall be made at such locations as the Engineer may allow, and shall in no case impair the structural strength of the structure.

B. Joints not indicated or specified shall be placed to least impair strength of structure and shall be subject to approval of the Engineer.

3.3 MIXING, CONSISTENCY, AND DELIVERY OF CONCRETE

A. Concrete shall be ready-mixed, produced by a central batch plant. Hand or site mixing shall not be allowed. Constituents, including admixtures, shall be batched at the central batch plant. Admixtures shall be premixed in solution form and dispensed as recommended by the manufacturer.

B. Central plant and rolling stock equipment and methods shall conform to Truck Mixer and Agitator Standard of Truck Mixer Manufacturer's National Ready-Mixed Concrete Association, ASTM C94, ASTM C685, and Contract Documents. Consistency of concrete at time of placement shall be at a 3 inch slump, +/- 1 inch.

C. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Discharge at site shall be within one and one-half hours after cement is first introduced into the aggregates. Concrete with a temperature greater than 90°F. shall be rejected and removed from the site.

D. During any of the following conditions: high ambient temperature, high concrete temperature, low relative humidity, increased wind velocity, high solar radiation, when the temperature of the concrete is 85°F or above, the time between the introduction of cement to the aggregates and discharge shall not exceed one hour. In addition, when the rate of evaporation on the surface of the concrete is expected to approach 0.2 $lb/ft^2/hr$. (see chart in ACI 305R) special precautions shall be taken against the formation of plastic shrinkage cracking on the surface of the concrete after placement.

E. During any period when for more than three successive days the average daily outdoor temperature drops below 40°F, the concrete temperature at the time of placement shall be as specified in Table C below.

TABLE C
Concrete Temperature During Cold Weather

Least dimension of section, inches.	**Minimum temperature of concrete as placed and maintained during the protection period, °F**	**Maximum gradual decrease in surface temperature during any 24 hours after end of protection, °F**
Less than 12	55	50
12 to less than 36	50	40
36 to 72	45	30
Greater than 72	40	20

F. Central mixed concrete shall be plant mixed a minimum of five minutes. Agitation shall begin immediately after premixed concrete is placed in truck and shall continue without interruption until discharged. Transit mixed concrete shall be mixed at mixing speed for at least ten minutes immediately after charging truck followed by agitation without interruption until discharged.

G. Retempering of concrete which has partially hardened by mixing with or without additional cement, aggregates, or water shall not be permitted.

3.4 PLACING CONCRETE

A. Remove excess water and foreign matter from forms and excavations. Do not place concrete on frozen soil. Provide adequate protection against frost action during freezing weather.

B. Transport concrete from mixer to place of final deposit as rapidly as practical by methods which prevent separation of ingredients and displacement of reinforcements, and which avoid re-handling. Do not deposit partially hardened concrete. When concrete is conveyed by chutes, equipment shall be of such size and shape to ensure continuous flow in chute. Flat (coal) chutes shall not be used. Chutes shall be of metal or metal lined and uniformly sloped. Slope shall not be less than 25° nor more than 45° from horizontal. Concrete shall be lowered and maintained as near to the surface of deposit as practicable. The chute shall be thoroughly cleaned before and after each use and debris and any water shall be discharged outside of the forms. Concrete shall not be allowed to flow horizontally over distances exceeding 10 feet or dropped vertically over 6 feet.

C. Place concrete in such a manner as to prevent segregation and accumulations of hardened concrete on forms or reinforcement above the grade of concrete being placed. Suitable hoppers and spouts with restricted outlets and tremies shall be used as required.

D. Thoroughly consolidate each layer of concrete by rodding and vibrating using internal type mechanical vibrator. Vibration shall be done by experienced operators under close supervision and shall be carried on only enough to produce homogeneity and optimum consolidation without permitting segregation of constituents or "pumping" of air. Vibrators used for normal weight concrete shall operate at speeds of not less than 7,000 vpm and be of suitable capacity. Do not use vibrators to move concrete. Vibration shall be supplemented by spading to remove bubbles and honeycombs adjacent to visible surfaces. At least one vibrator shall be on hand for every 10 cubic yards of concrete placed per hour, plus one spare. Vibrators shall be operable and on site prior to starting concrete placement.

E. Deposit concrete continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within the section. If a section cannot be placed continuously between planned construction joints, as specified, field joints and additional reinforcement shall be introduced at the Contractor's expense to preserve structural continuity.

F. Cold joints, particularly in exposed concrete, including "honeycombs", are unacceptable. If they occur in concrete surfaces exposed to view, the Engineer will require that entire section in which blemish occurs be removed and replaced with new materials at the Contractor's expense.

3.5 CURING AND PROTECTION

A. When concrete is placed at or below an ambient air temperature of 40°F. or whenever this temperature or lower values are likely to occur within 48 hours after placement of concrete, cold weather concreting procedures, according to ACI 306.1 and as specified herein, shall be followed. The entire area affected shall be protected by adequate housing or covering, and heating. No salt, chemicals or other foreign materials shall be

used in the mix to lower the freezing point of concrete. No oil or kerosene heaters shall be utilized. Vent flue gases from combustion heating units to the outside of the enclosure.

B. No frozen materials shall be used in batching concrete and any ice shall be removed from coming into contact with the concrete.

C. Protect concrete work against injury from heat, cold, and defacement of any nature during construction operations.

D. Concrete shall be treated and protected immediately after concreting or cement finishing is completed, to provide continuous moist curing above 50°F. for at least 7 days, regardless of ambient air temperatures.

E. All concrete shall be cured immediately after finishing in accordance with the following requirements:

1. Curing shall be accomplished by a continuous soaking process such as the use of soaker hose or sprinklers, or by use of plastic roll materials to cover the concrete, which shall be thoroughly wetted at least once a day or more often as required in very hot weather. Such plastic shall be placed as soon as possible after finishing of concrete so that scarring of the surface will not occur. Plastic shall be held in place on the surface of the concrete in such a manner and means as will not allow it to be blown off or otherwise dislodged from the concrete surface. Curing procedures shall be maintained continuously for a period of at least 7 days.

2. All methods of curing shall be subject to approval of the Engineer, and each method employed shall be practical and adequate for the curing required. Curing compounds in lieu of wet curing will not be allowed.

F. Keep permanent temperature records showing date and outside temperature during concreting operations. Thermometer readings shall be taken at start of work in morning, at noon, and again late in afternoon. Locations of concrete placed during such periods shall likewise be recorded in such manner as to show any effect temperatures may have had on construction.

3.6 REMOVAL OF FORMWORK

A. Forms shall not be removed until concrete has attained sufficient strength to support its own weight, construction loads to be placed thereon and lateral loads, without damage to structure or excessive deflection.

B. With the exception of construction joint bulkheads and keyways, forms and supports shall remain in place for not less than the minimum time periods noted below.

1. Unless specifically authorized by the Engineer, forms for vertical surfaces shall not be removed before the concrete has attained a strength of not less than 30 percent of the minimum allowable prescribed compressive strength nor not less than the minimum time period specified in Table D.

2. Unless specifically authorized by the Engineer, forms for horizontal surfaces shall not be removed before the concrete has attained a strength of not less than 60 percent of the minimum allowable prescribed compressive strength nor not less than the minimum time period specified in Table D.

TABLE D
Minimum Degree Day Requirement for Form Removal

Form Use	Degree-Days
Walls and Vertical Surfaces	200
Elevated Slabs	400
Beams and Girders	600

3. Definition of degree-days - Total number of days times mean daily air temperature at the surface of the concrete. For example, 5 days at temperature of 60°F. equals 300 degree-days. Days or fractions of days in which temperature is below 50°F. shall not be included in calculation of degree-days except where modified by Table C above.

C. Forms for construction joint bulkheads and keyways may be removed the following day, after the concrete pour. Extreme caution must be used to avoid damage to the concrete surface and keyway.

D. Any test cylinders required to verify the specified minimum strengths for form removal shall be field cured under the same conditions as the concrete they represent. Such cylinders and testing shall be at the Contractor's expense.

3.7 FINISHING OF CAST-IN-PLACE CONCRETE

A. Upper Horizontal Surfaces

1. Horizontal surfaces not subjected to wear, such as tops of parapets, copings, walls, etc., shall be formed by placing an excess of material in the forms and removing or striking off such excess with a template, forcing the coarse aggregate below the surface of the mortar.

2. Horizontal surfaces shall be attained by striking off excess concrete and in no case shall concrete be added to the tops of walls, etc., once initial set has taken place.

3. The top of such surfaces shall be finished in a manner as required and dictated by the necessary appearance of the part being finished. For covered surfaces, a wood float finish will in most cases be sufficient. Steel troweling may be necessary where concrete is exposed to view and adjacent surfaces have a steel trowel finish. In other cases, a "broom" finish may be required.

B. Slab Surfaces

1. Exterior slabs shall have a wood or magnesium trowel non-slip finish. The finish shall be accomplished by a procedure as follows, but shall be the Contractor's responsibility to produce a good and proper finish on all parts of the work:

a. "Broom Finish" - On exterior work such as sidewalks and where else called for, a broom finish shall be used. The finishing shall be accomplished in the following manner. Screeding shall be done and the surface worked up with a wood float. At a proper time thereafter, the surface shall be steel troweled at least once and more if so directed. Upon completion of troweling, a sufficiently stiff bristled broom shall be drawn lightly across the surface to produce a slightly striated finish. The brooming shall

in general be perpendicular to the main traffic route. Coordinate required finish with the Engineer before application.

2. For all of the finishing procedures described, the time element is important and something that must be determined during the progress of the work as conditions warrant. Normally, free water on the surface of concrete should not occur. Allow the concrete surface to dry before starting finishing operations. Do not, under any circumstance, add dry cement to wet areas in order to accelerate drying. Finishing and rubbing required for all parts of the work shall be done only by competent "Cement Finishers" trained for the work.

C. Formed Surfaces

1. Immediately after the end of the wet cure period, remove form ties and patch all tie-holes, rat holes, and other surface voids with a non-metallic, non-shrink grout, which most nearly matches the color and texture of the concrete surface. All protrusions shall be ground smooth with an approved mechanical grinder.

D. Surfaces Requiring Rub Finish

1. Rubbed finish of surfaces shall be provided on all poured interior and exterior vertical concrete surfaces and the underside of horizontal surfaces exposed to view, including all building and structure surfaces. Rubbing shall include but not be limited to:

   a. The exterior face of all building foundation walls, platforms and the like, from the top of the walls to 6 inches below grade, the interior faces of all building walls and ceilings, stair risers, retaining walls, stair cheeks, and the like.

2. Surfaces requiring a rubbed finish shall, when completed, shall present a smooth, even textured surface and proper appearance. The Engineer shall be the sole judge of the acceptability of a rubbed finish. Cement utilized in rubbing shall be of the same type manufacturer and source as that used in batching the concrete. The following procedure shall be required for all surfaces requiring a rubbed finish.

   a. Immediately upon removal of the forms, snap all form ties and fill tie holes with non-shrink grout to a point slightly indented from the finished surface. Hand chip all air pockets and laitance covered holes greater than 1/4 inch. A mechanical grinder of a type approved by the Engineer shall then be used to remove any form marks, ribs, or bulges, or other protruding surface defects.

   b. The surface shall then be wetted with clean water and a cement (4 parts), presifted fine sand (5 parts), and water grout shall be evenly applied utilizing a sponge float filling all exposed voids. The surface shall be rubbed with a burlap bag and allowed to thoroughly dry.

   c. The surface shall again be wetted and the grout reapplied with the sponge float and again rubbed with burlap, removing all excess material.

   d. After the final rubbing is completed, the surface shall be thoroughly drenched and kept wet for a period of 7 days unless otherwise directed by the Engineer. No other cement powder, grout or other surface coating will

be allowed. Plastering of surfaces requiring a rubbed surface will NOT be tolerated.

3.8 REPAIRING OF HARDENED CONCRETE SURFACES

A. Defective concrete and honeycombed areas shall not be patched unless examined and approval is given by the Engineer. After approval, areas involved shall be cut back to a minimum depth of 1 inch from the finished surface, or as otherwise directed, whichever is greater. Edges of areas to be repaired shall be cut square to a minimum depth of 3/4 inch. Feathered edges will not be allowed. Any voids or honeycomb around reinforcing steel shall be chipped away to provide at least 3/4 inch clearance all around to permit proper placement of repair concrete around the steel to the parent, sound concrete.

B. Exposed surfaces shall be thoroughly cleaned of all mud, paint, grime, scum, laitance, organic matter, detritus, calcareous growth and other foreign matter by sand and water blasting or other acceptable means. Immediately after cleaning, the surface shall be checked by the Engineer for proper surface preparation, including fractured concrete or loose aggregate. Any such material shall be removed using pneumatic or hand tools. The final surfaces shall be thoroughly rinsed with clean water to remove remaining dirt and dust.

C. Premoisten the prepared surface for at least 2 hours to reduce the absorption of water by the parent concrete and to provide a reservoir for moist curing at the interface of the repair. The substrate should be saturated surface dry with no standing water. While the concrete surface is still damp, apply a thin 1/16 inch coat of neat cement slurry (mixed to the consistency of a heavy paste) with a bristle brush to provide a bond coat throughout the entire cavity of the repair. Before the slurry has dried or changed color, promptly install the repair concrete or dry-pack, as may be required or selected.

D. For relatively small areas, ram repair concrete into this portion of the formed void. This concrete shall comprise a crumbly-dry 1-1-1.5 mixture of cement, concrete sand and pea gravel (or 3/4 inch gravel) mixed slightly damp to the touch (just short of "balling"). The "dry-pack" consistency of the concrete shall be zero slumps, but moist enough so that when it is rodded and tamped until dense, an excess of paste will appear on the surface in the form of a spider web. In cases of unformed voids of thinner section, do not build-up repair in excess of a depth which will sag with the weight of the fresh mortar or concrete. Trowel smooth with heavy pressure.

E. The concrete shall be of the driest possible consistency and mix composition so that it can be worked into the corners and angles of forms and around the reinforcement, without permitting the materials to segregate or free water to collect on the surface, due consideration being given to the methods of placing and compacting. Source and mixture of concrete shall be submitted for approval.

F. Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited which has hardened sufficiently to cause the formation of seams and planes of weakness within the section. Concrete shall be thoroughly consolidated and trowelled dense, smooth and plane. Avoid premature and excessive trowelling which could cause sagging.

G. Repair areas and adjacent parent concrete surfaces shall be continuously moist cured immediately after finishing for at least 7 days. Surfaces shall be covered with damp burlap and sealed with taped polyethylene. Membrane curing compounds shall not be used.

H. Leave finished work and adjacent concrete surfaces in a neat, clean condition with no evidence of spillovers or staining.

3.9 CLEANING

A. Concrete surfaces shall be cleaned of objectionable stains as determined by the Engineer. Materials containing acid in any form or methods which will damage the "skin" of concrete surfaces shall not be employed, except where otherwise specified.

END OF SECTION

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0SECTION 03485

PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Wet Wells
2. Valve Vaults

B. Related Sections

1. Section 02315 - Excavating, Backfilling and Compacting
2. Section 02530 – Sanitary Manholes
3. Section 03300 - Cast-in-Place Concrete
4. Section 09900 - Painting
5. Section 11312 - Submersible Wastewater Pumping Equipment

1.2 REFERENCES

A. State Building Code, most recent edition.

B. Precast Concrete Institute (PCI)

1. MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

C. American Concrete Institute (ACI)

1. ACI 301 - Specifications for Structural Concrete for Buildings, (included as part of this specification).
2. ACI 318 - Building Code Requirements for Reinforced Concrete.
3. ACI 350 - Environmental Engineering Concrete Structures.

D. American Society for Testing and Materials (ASTM)

1. ASTM A615 - Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Method of Testing for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C150 - Standard Specification for Portland Cement.
5. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

1.3 SUBMITTALS

A. Submit to the Engineer, as provided in Section 01330, material specifications, and shop drawings for all materials specified and furnished under this Section. Submittals shall detail size and elevations of all structure penetrations, sleeve materials and sleeve elevations.

B. The drawings show a generalized configuration for the precast concrete structures. Submittals shall include separate scaled, detailed drawings for each precast concrete structure.

C. Submit to the Engineer shop drawings sealed by an Engineer registered in the State of Connecticut, and material specifications for all materials specified and furnished under this Section. Submittals shall include: details of underground structures, accessories, fittings, connections, size and elevations of all structure penetrations, sleeve materials and sleeve elevations.

D. Submit structural design calculations including verification of adequate anti-flotation features prepared and sealed by an Engineer registered in the State of Connecticut.

E. Submit manufacturer's data on structures, and associated specialty products.

1.4 QUALITY ASSURANCE

A. Design Criteria

1. Precast concrete units shall be designed for all applicable dead loads and wall live loads, weight of soil of at least 120 pcf, building, vault, wet well, manhole and H-20 truck loading.

2. Precast concrete unit shall be designed to resist buoyancy with a flood water table up to the ground surface elevation as shown on the Drawings.

3. Precast unit shall be designed in accordance with ACI 318 and ACI 350.

4. Comply with applicable requirements of American Society for Testing and Materials (ASTM) standards pertaining to construction and materials for precast structures.

5. Pipe supports shall be supported by the precast walls, ceiling, or floor as indicated on the drawings.

B. Fabricator Qualifications – Contractor shall employ a firm that has at least 5 years successful experience in fabrication of precast concrete units similar to units required for this project.

1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and participate in its Plant Certification Program.

C. Contractor's Qualifications - Firms with at least 3 years of successful installation on projects with structures, similar to those required for project.

D. Allowable Tolerances

1. Dimensional and erection tolerances shall be in accordance with PCI MNL-116 or as modified herein.

2. Compression test results shall be evaluated in accordance with ACI 214. Concrete strength level will be considered satisfactory if the average of all sets of 3 consecutive strength test results equal or exceed the specified compressive strength and no individual strength test results fall below the specific compressive strength by more than 500 psi.

E. Source Quality Control

1. One set of 4 compression test cylinders shall be made for each day's production for each type of precast Unit. Make compression test specimens in accordance with ASTM C31. Obtain concrete for specimens from actual production batch. Cure specimens using same methods used for curing precast units.

2. 2 specimens shall be tested at 28 days for acceptance, one shall be tested prior to removing forms, and one shall be tested at seven days. Compression tests shall be conducted in accordance with ASTM C39. Do not remove precast units from forms unless strength tests have been completed and results are equal to, or greater than, minimum required values.

F. Provide 7 day written notification to the Owner's Project Representative prior to casting the structures. The Engineer may sample the concrete and inspect reinforcement placement at the time of fabrication.

G. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Owner's Project Representative. Such inspection may be made at the place of manufacture, or on the work 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 Specifications 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. All materials, which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

H. At the time of inspection, the materials will be carefully examined for compliance with these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

I. Imperfections in sections may be repaired, subject to the approval of the Owner's Project Representative, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall 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.

J. Plans and calculations for the precast structures shall be approved and stamped by a Structural/Civil Professional Engineer registered in the State of Connecticut.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Equip and protect factory-fabricated product to prevent damage, including chipping and cracking during transportation, storage and handling. Do not install damaged units; replace, and remove damaged units from project site at the Contractor's expense.

B. Lift and support units only at designated lift points. Provide permanent lifting hooks on the top.

C. Protect all lifting devices from rusting by applying red lead primer.

D. Do not store units on soft ground.

E. Provide setting diagrams and instructions as required for installation.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement - ASTM C150, Type III.

B. Aggregates - ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

C. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Engineer.

D. Water - Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

E. Air-Entraining Admixture - ASTM C260, not containing calcium chloride.

F. Water-Reducing Admixture - ASTM C494, Type A, not containing calcium chloride.

G. Calcium Chloride - Not permitted.

2.2 FORM MATERIALS

A. Forms shall be of metal or wood. If unlined wood forms are used, they shall be of selected material with tongue and groove joints and shall be kept continuously wet to prevent shrinking and warping due to exposure to the elements. Non-staining form oil shall be used.

B. Forms shall be sufficiently tight to prevent leakage of mortar.

C. Forms shall be accurately constructed, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations and temperature changes.

D. Coat surface of forms with bond-breaking compound before reinforcement is placed. Provide a commercial formulation form-coating compound that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

2.3 REINFORCEMENT

A. Reinforcement shall be clean of loose rust and mill scale, earth and other materials, which reduce or destroy bond with concrete.

B. Reinforcing steel shall be new billet steel conforming to ASTM Specification A615 (latest edition), Grade 60.

C. Reinforcement shall be accurately positioned, supported, and secured against displacement by formwork construction, or concrete placement operations. Locate and

support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required. Welding of reinforcement is strictly prohibited

D. Place reinforcement to obtain at least the minimum coverage for concrete reinforcing protection. Minimum allowable cover shall be ¾ inch.

2.4 GROUT MATERIALS

A. Non-metallic Shrinkage-Resistant Grout - Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents. Compressive strength not less than 10,000 psi. at 28 days.

1. Products - Subject to compliance with requirements, provide one of the following:

a. Eucocrete; Euclid Chemical Co.

b. Crystex; L&M Construction Chemicals

c. Masterflow 713; Master Builders

d. Five Star Grout; U.S. Grout Corp.

e. Upcon; Bostik Construction Products

f. or equal.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

C. Produce standard-weight concrete consisting of the specified Portland cement, aggregates, admixtures, and water to produce the following properties.

1. Compressive strength; 5,000 psi. minimum at 28 days.

2. Air entrainment shall be 4.5% plus or minus 1%.

D. Admixtures

1. Use air-entraining admixture in concrete, unless otherwise indicated.

2. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used.

3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.6 FABRICATION

A. General - Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances specified for the type of unit required.

B. Clean reinforcement of the loose rust and mill scale, earth and other materials that reduce or destroy bond with concrete.

C. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

D. Identification - Provide permanent markings to identify pickup points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in finished structure.

E. Fabricate precast concrete units as detailed in accordance with approved erection drawings and to meet requirements of these specifications.

F. Each precast module shall be provided with formed male and female joints to insure accurate joint surfaces and tolerance for a watertight seal. All joints between adjoining precast modules shall be sealed when modules are set in the field utilizing a vulcanized butyl rubber compound sealant conforming to AASHTO M-198 (latest revision). Sealant shall be "Conseal CS-102" as manufactured by Concrete Sealants, New Carlisle, Ohio or equivalent.

G. All surfaces of the precast structure shall be smooth, even and free from roughness, irregularities and other defects, and shall be suitable for receiving the interior and exterior finishes specified elsewhere herein.

H. Sleeves for pipe and conduit penetrations shall be Schedule 40 aluminum or stainless steel. Surfaces in contact with concrete shall be bituminous coated. Sleeves shall be sized to accommodate compression bolted linked rubber sealing devices. Conduit shall be sealed watertight utilizing compression bolted conduit seals. Mechanical seals shall be "Link-Seal" as manufactured by Thunderline, or equivalent. Omni-sleeves are acceptable in lieu of linked rubber sealing devices. All pipe penetrations shall have mechanical seals located at the inside and outside face of any wall penetrations.

I. A flexible pipe-to-structure connector shall be used.

1. The flexible connectors shall be designed to provide a positive seal between the connector and the structure wall and between the connector and the pipe.

2. 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.

3. The external bands shall be made entirely of 304 series non-magnetic stainless steel.

4. The flexible connectors shall be provided with a wedge-type or toggle-type expander to secure the pipe in the structure opening.

5. The flexible connectors shall meet the following criteria, in accordance with ASTM C923:

   a. Shall not leak when subjected to a head pressure of 10 psi for 10 minutes.

   b. Shall have the ability to deflect 7 degrees in any direction without leakage under the head pressure conditions described above.

   c. Shall not leak when subject to a load of 150 lbs./in. pipe diameter and the head pressure conditions described above.

J. The precast concrete structures shall be constructed to the lengths, widths and heights as shown on the Plans. The structures shall be designed to adequately and safely support all live and dead loads to which the structure will be subjected, and to withstand all conditions which may be encountered. Structural drawings and calculations shall be prepared, signed and sealed by a registered Professional Engineer in the State in which the structure is to be installed, and shall be included with the submittal by the Contractor.

1. Design calculations shall verify that the structure has been designed to withstand the burial depth, submergence due to flooding, anti-flotation, and the dead and live loads anticipated for the structure. The structures shall have adequate wall, floor and roof thickness and steel reinforcement sufficient for the depth of burial shown on the Plans.

2. Roof slab/ceiling designs shall account for the loads imposed on the slab by the weight of pumps or other equipment that will be lifted from their positions for maintenance purposes by lifting hooks or other hoisting equipment installed in the slab.

K. The precast concrete structures shall have minimum wall, floor and roof thickness of 6 inches. The structures shall have a design loading in accordance with AASHTO-HS20-44 and be constructed of 5,000 psi. 28 days strength concrete. Reinforcing steel shall be in accordance with ASTM A615 Grade 60 with a minimum of 1 inch of concrete cover.

2.7 ACCEPTABLE PRECAST STRUCTURE MANUFACTURERS

A. Manufacturers - Subject to compliance with requirements, provide prefabricated unit of one of the following:

1. Arrow Concrete Products, Inc.
2. American Precast Corp.
3. Chase Precast
4. Old Castle/Rotondo & Sons, Inc.
5. Ditullio & Sons, Inc.
6. Utility Vault Co.
7. TRENWA
8. or equal

2.8 ACCESSORY PRODUCTS

A. Access Hatch

1. See section 08310 for hatch requirements.
2. All Hatches shall be equipped with safety grating. . Hatches indicated for valves vaults (showing an associated ladder – per the Drawings) shall include a ladder-up device.

PART 3 EXECUTION

3.1 INSPECTION

A. Installer must examine areas and conditions under which each structure is to be installed, and notify Contractor in writing of those conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.2 INSTALLATION OF FACTORY-FABRICATED UNITS

A. General - Install structure as indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure compliance with requirements and intended purposes.

B. Precast Concrete Units - Place precast concrete sections as indicated.

1. Install rubber joint gasket at joints between sections.

2. Apply bituminous mastic coating at joints between sections.

3. Apply butyl rubber sheet patch at exterior of all joints.

4. Apply bonding agent to enhance the adhesion of the grout to the concrete floor.

3.3 DAMPPROOFING

A. Below-grade outer surfaces of precast units shall be given two coats of bituminous damp proofing at the rate of 30-60 sq. ft. per gallon in accordance with manufacturer's instructions.

3.4 BACKFILLING

A. General - Delay backfilling of excavation until after Owner's Project Representative's inspection has been completed. Backfilling shall be in accordance with Section 02315.

3.5 LEAKAGE TEST

A. Watertightness test: The structures shall be tested for watertightness. Completely fill tanks and allow them to stand for 24 hours. Top up tanks as necessary. Measure the drop in liquid level over the second 24-hour period. Watertightness shall be defined as loss of liquid level less than 0.5% in 24 hours.

B. Watertightness Test Failure - In case leakage exceeds the above specified amount, locate the leaks and repair them at no additional cost to the Owner.

END OF SECTION

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SECTION 05500

MISCELLANEOUS METALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum ladders.

2. Safety climb device.

B. Related Sections

1. Section 05050 – Welding.

2. Section 05120 – Structural Steel

3. Section 09900 – Painting.

1.2 REFERENCES

A. The State of Connecticut State Building Code, latest Edition

B. American Iron and Steel Institute (AISI), Stainless Steel Types

1. AISI Type 316 - Stainless Steel Bolts, Bars, Sheets and Shapes

2. AISI Type 316L - Stainless Steel Bars, Shapes, Plates and Pipe

C. American National Standards Institute (ANSI)

1. A14.3, Safety Requirements for Fixed Ladders

D. American Society for Testing and Materials (ASTM)

1. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

2. B210, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes

3. B221, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

4. B241, Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

5. B316, Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold Heading Wire and Rods

6. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

E. International Conference of Building Officials (ICBO): Evaluation Reports for Concrete and Masonry Anchors.

F. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1910.27, Fixed Ladders.

G. National Association of Architectural Metal Manufacturers (NAAMM):

1. ANSI MBG 531, Metal Bar Grating Manual.

2. ANSI MBG 532, Heavy-Duty Metal Bar Grating Manual.

3. Metal Stairs Manual.

H. Steel Structures Painting Council (SSPC)

I. The Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.3 SUBMITTALS

A. Product Data:

1. Concrete and Masonry Drilled Anchors:

a. Manufacturer's product descriptions.

b. Specific installation instructions, including drilled hole size, preparation, placement procedures, and instructions for safe handling of anchoring systems.

2. Safety Climb System:

a. Manufacturer's product descriptions.

b. Certification of system load ratings.

c. Installation, Operation, and Maintenance Instructions.

3. Prime Paint.

4. Bitumastic Troweling for Surfaces in Contact with Concrete.

B. Shop Drawings:

1. Detailed shop drawings, including erection drawings, for all metal fabrications, including welding and fastener information:

a. Submit for approval before fabrication.

b. Identify sizes of structural members, method of assembly, anchorage, and connection to other members.

2. Ladders:

a. Certification of load and fatigue tests to verify design loads and deflection on rungs and rungs to side rail attachments:

1) Testing shall be certified by an independent testing laboratory.

2) Design loads shall be applied and released for a minimum of 200,000 cycles to demonstrate fatigue resistance and service life.

3) Deflection shall be checked periodically and shall not exceed L/360 at any time under full load.

4) After completion of testing, all components and attachments shall be inspected and certified to be free of cracks, distortion, permanent deformation (bending) or other signs of defect or damage.

3. Provide Certificates of Compliance on other materials as requested by the Engineer.

1.4 QUALITY ASSURANCE

A. Shop Assembly: Pre-assemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. All handrails, grating, and stair nosings, etc. shall comply with OSHA, ADA, and The State of Connecticut State Building Code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and stack materials carefully to prevent deformation or damage.

B. Store materials carefully on substantial timbers and blocking, so arranged that materials will be free from earth and properly drained, preventing any splattering with dirt or accumulation of water or snow in or about materials.

C. Prevent accumulation of mud, dirt, or other foreign matter on materials. Any accumulation shall be completely removed prior to erection.

D. Protect painted, hot-dip galvanized, and other finishes from damage due to metal banding and rough handling. Use padded slings and straps.

E. Adhesive Anchor Systems:

1. Store adhesive cartridges on pallets or shelving in covered storage area, in accordance with manufacturer's written instructions.

2. Cartridge Markings: Include manufacturer's name, product name, material type, batch or serial number, and adhesive expiration date.

3. Dispose of cartridges if shelf life has expired.

PART 2 PRODUCTS

2.1 MATERIALS

A. Unless otherwise indicated, meet the following requirements:

Aluminum:

Extruded Shapes	B221, Alloy 6061, Temper T6
Pipe	B210, Alloy 6063, Temper T6
Aluminum Sheet	B209, Alloy 3003, Temper H14

2.2 MANUFACTURED UNITS

A. Concrete and Masonry Drilled Anchors

1. General: Materials shall be AISI Type 316 stainless, hot-dip galvanized, or zinc-plated steel, as shown in Data Sheet – 05500 – A, FASTENER MATERIALS SCHEDULE, at end of this section.

2. Wedge Anchors:

a. Manufacturers and Products:

1) ITW Ramset/Red Head, Wood Dale, IL; Trubolt Wedge Anchor.

2) Hilti, Inc., Tulsa, OK; Kwik-Bolt II Stud Anchor.

3) Powers Rawl, New Rochelle, NY; Power-Stud Anchor.

4) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Wedge-All Anchor.

5) Wej-It Corp., Tulsa, OK; ANKRtite Wedge Anchor.

6) U.S. Anchor, Pompano Beach, FL; Kingpin Wedge Anchor.

3. Expansion Anchors:

a. Self-drilling anchors, snap-off or flush type, zinc-plated.

b. Nondrilling Anchors: Flush type for use with zinc-plated or stainless steel bolt, or stud type with projecting threaded stud.

c. Manufacturers and Products:

1) ITW Ramset/Red Head, Wood Dale, IL; Multi-Set II Drop-In and Self Drill Anchor.

2) Hilti, Inc., Tulsa, OK; Hilti HDI Drop-In Anchor.

3) Powers Rawl, New Rochelle, NY; Steel Drop-In Anchor.

4) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Drop-In Anchor.

4. Sleeve Anchors:

a. Manufacturers and Products:

1) ITW Ramset/Red Head, Wood Dale, IL; Dynabolt Hex Nut Sleeve Anchor.

2) Powers Rawl, New Rochelle, NY; Hex Head Power-Bolt Anchor.

3) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Sleeve-All Hex Head Anchor.

4) Wej-It Corp., Tulsa, OK; Wej-It Sleeve Anchor.

5. Adhesive Anchors:

a. Threaded Rod:

1) ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.

2) Length as required, to provide minimum depth of embedment.

3) Clean and free of grease, oil, or other deleterious material.

4) For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.

b. Adhesive:

1) Disposable, self-contained cartridge system capable of dispensing both components in the proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.

2) Two-component, designed to be used in adverse freeze/thaw environments, with gray color after mixing.

3) Cure Temperature, Pot Life, and Workability: Compatible for intended use and environmental conditions.

4) Nonsag, with selected viscosity base on installation temperature and overhead application where applicable.

c. Manufacturers and Products:

1) ITW Ramset/Red Head, Wood Dale, IL; Epcon Ceramic 6 Epoxy or A7 Adhesive Anchor System. (Use only Epcon A7 Adhesive System for hollow masonry.)

2) Hilti, Inc., Tulsa, OK; HIT Injection Adhesive System, HIT HY 200 (HIT HY 70 for hollow masonry).

3) Powers Rawl, New Rochelle, NY; Power Fast Epoxy Injection Gel Cartridge System.

4) Simpson Strong-Tie Co., Inc., Pleasanton, CA; Epoxy-Tie Adhesive ET.

5) Covert Operations, Inc., Long Beach, CA; CIA-Gel 7000 Epoxy Anchors.

6) Unitex, Kansas City, MO; Pro-Poxy 300 and Pro-Poxy 300 Fast Epoxy Adhesive Anchors.

6. Adhesive Threaded Inserts:

a. Stainless steel, internally threaded insert.

b. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-R Insert with HIT HY 200 adhesive.

B. Fasteners:

1. Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Data Sheet – 05500 – A, FASTENER MATERIALS SCHEDULE, at the end of this section.

2. Bolts, Nuts and Washers: ASTM A325, galvanized to ASTM A153 for galvanized members.

3. Anchor Bolts: ASTM F1554, Grade 36

4. High-Strength Bolts: ASTM A325 or ASTM A490, Type 1, plain uncoated. Bolt length and thread length shall be as required for the connection type shown, with hardened washers as required.

C. Aluminum Ladders

1. The ladders and all ancillary equipment shall be fabricated in accordance with the details on the plans and described herein and shall comply with the requirements of ANSI-A14.3.

2. Ladder side rail shall be 1-1/2 inch diameter Schedule 40 pipe, alloy 6063-T6, 6105-T5 or 6105-T6. Ladder side rail pipe shall conform to ASTM B429 or ASTM B221.

3. Ladder rungs shall be extruded aluminum, alloy 6063-T6, with a non-slip power grip surface, flat 1 inch wide serrated top surface, straight sides and a semi-circular bottom. The rung sides and bottom shall have striations at approximately 5/16 inch centers for gripping surface.

4. Other ladder system components:

a. Brackets and base flanges - aluminum.

b. Anchors, bolts, and screws - stainless steel (unless noted otherwise on the plans).

c. The contractor shall refer to the plans for ladder system details and component locations.

5. The ladder shall be designed for the following minimum loads:

a. Rungs - 250 lbs concentrated load plus 30 percent impact. (Maximum rung deflection shall not exceed L/360). The design load shall be applied at the center of the rung over a 4 inch wide area.

b. Side rails - 250 lbs. live load plus 30% impact concentrated between any two consecutive attachments.

6. Submit test reports for approval to verify design loads and deflection on rungs and rungs to side rail attachments. Testing shall be certified by an independent testing laboratory. Design loads shall be applied and released for a minimum of 200,000 cycles to demonstrate fatigue resistance and service life. Deflection shall be checked periodically and shall not exceed L/360 at any time under full load. After completion of testing all components and attachments shall be inspected and certified to be free of cracks, distortion, permanent deformation (bending) or other signs of defect or damage.

2.3 ACCESSORIES

A. Welding Materials: In accordance with the requirements of Section 05050.

B. Electrolysis Isolators: All dissimilar metals shall be isolated over their full length with 1/8 inch thick neoprene unless otherwise noted.

C. Safety Climb Device:

1. General:

a. Conforms to ANSI A14.3 and OSHA CFR Part 1910.27.

b. Belt and harness shall withstand minimum drop test of 250 pounds in 6 foot free fall.

c. Fall Prevention System Material: Aluminum 6061-T6.

2. Components and Accessories:

a. Main Components: Sleeve or Trolley, Safety Harness, and Carrier or Climbing Rail.

b. Ladder rung clamps with aluminum mounting brackets and hardware.

c. Removable extension kit with tie-down rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

3. Manufacturers and Products:

a. North Safety Products, Specialty Products Division, Toronto, Ontario, Canada; Saf-T-Climb Fall Prevention System.

b. Miller Equipment, Franklin, PA; Sure Track Rail System.

c. TS Products, St. Charles, IL; TS Safety Rail System.

2.4 SHOP FABRICATION

A. General

1. All dimensions shall be verified at the site before fabrication is started.

2. Galvanized items shall be shop fabricated and completely welded prior to galvanizing.

3. Fit and shop assemble items in largest practical sections, for delivery to site.

4. Fabricate items with joints tightly fitted and secured.

5. Welding shall be in accordance with the requirements of Section 05050.

6. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

7. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with the design of the component, except where specifically noted otherwise.

8. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

9. Miscellaneous metals work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

10. Metal Surfaces: For fabrication of miscellaneous metal work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

11. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fittings.

12. Castings shall be of good quality, strong, tough, even-grained, 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. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. Finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95% of the theoretical weight computed from the dimensions shown.

13. No splicing of any member or part of the work will be allowed where full-length members are commercially available.

14. Screws, bolts, studs and other connecting devices required in the work shall be concealed wherever possible. On all finish work where fasteners must be exposed to view, they shall be countersunk and finished flush with the exposed surfaces. All screws, bolts and other fastening devices used for exterior work shall be aluminum, bronze or stainless steel, whichever is appropriate for the work in which it is to be used.

B. Fabrication Tolerances:

1. Squareness: 1/8 inch maximum difference in diagonal measurements.

2. Maximum Offset Between Faces: 1/16 inch.

3. Maximum Misalignment of Adjacent Members: 1/16 inch.

4. Maximum Bow: 1/8 inch in 48 inches.

5. Maximum Deviation From Plane: 1/16 inch in 48 inches.

2.5 FINISHES

A. Aluminum Materials

1. Finished contact surfaces, such as ladders, shall be finished in accordance with the Aluminum Association designation AA-M32C22A41.

2.6 SOURCE QUALITY CONTROL

A. Miscellaneous Metals fabrications, materials, and workmanship shall be subjected to inspection and testing in mill, shop and/or field by the Engineer.

B. Inspection and testing of shop welding shall be in accordance with the requirements of Section 05050. Repair and retest defective welds as specified in Section 05050.

C. Maintain inspection and quality control records of shop and field work.

D. The Contractor shall maintain records of each impact wrench used in the shop, showing dates, sizes of bolts tested and the corresponding torque values. Certified copies of the records shall be made available to the Engineer, upon request.

E. Notify the Engineer prior to start of any fabrication, the start of sandblasting and painting, or other phases of work so as to afford them reasonable opportunity to inspect work.

F. Furnish the Engineer upon request, with the following:

1. Complete sets of approved Shop Drawings and corrective work procedures at fabricating shop(s) and in field.

2. Cutting lists, order lists, material bills, and shipping lists.

3. Information as to time and place of all rollings and shipments of material to shops and field.

4. Representative sample pieces requested for testing.

5. Full and ample means and assistance for testing materials, and proper facilities for inspection of work, in mill, shop and field.

G. Do not remove any marks or tags identifying rejected work.

H. Any work found deficient shall be corrected or replaced in accordance with these specifications. Deficient welds shall be cut out to sound material and re-welded. Deficient assemblies shall be taken apart, corrected and reassembled, using new materials as required. ASTM A490 bolts shall not be reused. ASTM A325 bolts may be retightened once only.

I. Miscellaneous Metals work that has been rejected by the Engineer in the mill or shop shall be corrected without delay and at no expense to the Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify that anchor bolts, bearing plates, and other items furnished to be installed by others have been installed correctly.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. All steel and aluminum surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling applied in accordance with manufacturer's instructions prior to installation.

3.3 FIELD FABRICATION

A. No fabricated section shall be cut in the field without the permission of the Engineer.

B. All miscellaneous metals work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

C. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fittings.

D. No splicing of any member or part of the work will be allowed where full-length members are commercially available. Jointing shall meet the approval of the Engineer.

E. Screws, bolts, studs and other connecting devices required in the work shall be concealed wherever possible. On finish work where fasteners must be exposed to view, they shall be countersunk and finished flush with the exposed surfaces. Screws, bolts and other fastening devices used for exterior work shall be aluminum, bronze or stainless steel, whichever is appropriate for the work in which it is to be used.

3.4 INSTALLATION

A. Install all items furnished except items to be imbedded in concrete or masonry. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

3.5 ANCHOR BOLTS

A. Accurately locate and hold anchor bolts in place with templates at the time concrete is placed.

B. Use sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.

3.6 CONCRETE AND MASONRY DRILLED ANCHORS

A. Begin installation only after concrete or masonry to receive anchors has attained design strength.

B. Install in accordance with manufacturer's instructions.

C. Provide minimum embedment, edge distance, and spacing as follows, unless indicated otherwise by anchor manufacturer’s instructions or shown otherwise on Drawings:

Anchor Type	Min. Embedment (bolt diameters)	Min. Edge Distance (bolt diameters)	Min. Spacing (bolt diameters)
Wedge	9	6	12
Expansion and Sleeve	4	6	12
Undercut	9	12	16
Adhesive	9	9	13.5

D. Use only drill type, bit type, and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and compressed air.

E. For undercut anchors, use special undercutting drill bit and rotary hammer drill and apply final torque as recommended by anchor manufacturer.

F. When embedded steel or rebar is encountered in the drill path, slant drill to clear obstruction. If drill must be slanted more than 10 degrees to clear obstruction, notify Engineer for direction on how to proceed.

G. Adhesive Anchors:

1. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F.

2. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry where required by manufacturer's instructions.

3. Do not disturb anchor during recommended curing time.

4. Do not exceed maximum torque as specified in manufacturer's instructions.

3.7 FIELD QUALITY CONTROL

A. The fact that Miscellaneous Metals work has been accepted at the shop shall not prevent its final rejection at the job site, even after it has been erected, if it is found to be defective in any way.

B. Miscellaneous Metals erection, materials, and workmanship shall be subjected to inspection and testing in mill, shop and/or field by the Engineer.

C. Inspection and testing of field welding shall be in accordance with the requirements of Section 05050.

D. Maintain inspection and quality control records of shop and field work.

E. Notify the Engineer prior to start of any miscellaneous metals erection, or other phases of work so as to afford them reasonable opportunity to inspect work.

F. Furnish the Engineer upon request, with the following:

1. Complete sets of approved Shop Drawings and corrective work procedures at fabricating shop(s) and in field.

2. Full and ample means and assistance for testing materials, and proper facilities for inspection of work, in mill, shop and field.

G. Do not remove any marks or tags identifying rejected work.

H. Any work found deficient shall be corrected or replaced in accordance with these specifications, without delay and at no expense to the Owner.

3.8 ADJUST AND CLEAN

A. Touch-Up Painting - Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as approved for use for shop painting.

B. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

C. For galvanized surfaces, clean field welds, bolted connections and abraded areas and touch-up all damage using suitable touch up material complying with ASTM A780.

3.9 FASTENERS

A. Anti-seizing Lubricant: Use on all stainless steel threads.

B. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

C. Provide fasteners in accordance with Data Sheet – 05500 – A, unless otherwise noted on the drawings.

DATA SHEET 05500-A
Fastener Materials Schedule

Service Use and Location	Product	Remarks
Anchor Bolts Cast Into Concrete for Equipment Bases		
All Areas	Stainless steel headed anchor bolts, unless otherwise specified with equipment	
Drilled Anchors for Metal Components to Concrete (Ladders, Handrail Posts, Electrical Panels, and other Equipment)		
Exterior and Interior Wet and Dry Areas	Hot-dip galvanized steel or stainless steel sleeve, wedge, or expansion anchors, or stainless steel adhesive anchors	Use zinc-plated undercut anchors for overhead and ceiling installations.
Submerged or Corrosive Areas	Stainless steel adhesive anchors	

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. Prefabricated roof trusses
2. Wood nailers and blocking
3. Plywood sheathing

B. RELATED SECTIONS

1. Section 13121 – Precast Concrete Structure

1.2 REFERENCES

A. The State of Connecticut State Building Code, latest edition

B. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

C. ASTM A446 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

D. ASTM D1761 - Testing Mechanical Fasteners in Wood

E. ASTM E489 - Tensile Strength Properties of Steel Truss Plates

F. ASTM E767 - Shear Resistance of Steel Truss Plates

G. AWPA Analytical Standards: A2-98, A3-00, A9-00, A16-93, A17-97, A18-99

H. AWPA C1 - All Timber Products

I. AWPA C2 – Lumber, Timber, Bridge Ties and Mine Ties

J. AWPA C9 - Plywood

K. AWPA C15 - Wood for Commercial-Residential Construction

L. AWPA P5 - Waterborne Preservatives

M. AWPA M4 - Standard for the Care of Preservative Treated Wood Products

N. ICBO ES ER-4981

O. National Evaluation Report (NER): Report No. NER-628

P. National Evaluation Report (NER): Report No. NER-643

Q. Inspection Agencies - Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:

ALSA - American Lumber Standards Committee: Softwood Lumber Standards

APA - American Plywood Association

NFPA - National Forest Products Association

RIS - Redwood Inspection Service

NELMA – Northeastern Lumber Manufacturers Association

NLGA - National Lumber Grades Authority (Canadian)

SPIB - Southern Pine Inspection Bureau

WCLIB - West Coast Lumber Inspection Bureau

WWPA - Western Wood Products Association

R. Truss Plate Institute (TPI)

1. Recommended Code of Standard Practice for the Metal Plate Connected Wood Truss Industry

2. Quality Control Manual

3. Bracing Wood Trusses: Commentary and Recommendation

4. Design Specification for Metal Plate Connected Wood Trusses

1.3 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.4 SUBMITTALS

A. Submit chemical treatment manufacturer's instructions for handling, storing, installation and finishing of treated material.

1. For each type of pressure treatment specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.

2. For water-borne treatment, include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

3. Evaluation Report:

a. NER-628

b. NER-643

c. ICBO ES ER-4981

4. Warranty documents

B. Submit shop drawings prepared and sealed by a Connecticut Registered Structural Professional Engineer showing complete information for fabrication and installation of wood truss. Indicate member dimensions; location, size and type of steel plate truss, including lateral bracing.

1. Indicate layout, dimensions, and identification of each unit corresponding to sequence and procedure of installation. Detail inserts, connections, and joints, including accessories and construction at openings in truss.

2. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

3. Include erection procedure for truss units and sequence of erection.

4. Provide complete design calculations for approval, prepared and sealed by a Connecticut Registered Professional Structural Engineer.

C. Submit shop drawings of wood blocking installation and other rough carpentry work. Describe proposed methods of installation and anchorage to structure showing sizes, types, thicknesses, connections of wood blocking and related items, including adjoining work by other trades.

D. Take all necessary field measurements before preparation of shop drawings and fabrication. Do not delay progress of the job. If field measurements are not possible prior to fabrication, allow for field cutting and fitting.

E. Manufacturer's literature for all metal connectors and framing anchors

F. Wood-preservative-treatment data from chemical treatment manufacturer. Include certification of chemical solution and affirm that it complies with indicated treatment standard.

1.5 QUALITY ASSURANCE

A. Design standards shall conform to applicable provisions of NFPA and TPI Specification.

B. Source: For each material type required for the work of this section, provide primary materials that are the product of one manufacturer. Provide secondary or accessory materials that are acceptable to the manufacturers of the primary materials.

1. Alkaline copper quaternary (ACQ) preservative-treated wood products from a single approved source.

2. Wood Treatment Plant Qualifications: Wood treatment plant experienced in performing work of this section which has specialized in the treatment of wood similar to that required for this project, licensed by the manufacturer.

C. Installer: A firm with a minimum of three years experience in type of work required by this section and which is acceptable to the truss manufacturers.

D. Engineering: Provide the services of a Professional Engineer, registered in the State of Connecticut, to design and certify that the work of this section meets or exceeds performance requirements specified.

E. Regulatory Requirements: Provide preservative treatment that complies with the following regulatory requirements:

1. NES Report No. NER-643

2. ICBO ES ER-4981

F. Quality Mark: All ACQ preservative-treated wood members shall bear an end tag or permanent ink stamp indicating the following:

1. Name of wood treating company

2. Treatment plant city and state

3. Symbol for alkaline copper quaternary (ACQ)

4. Preservative retention level

5. Approved use

6. Code report number

1.6 TESTING AND INSPECTION

A. Materials and workmanship under this Section may be subject to inspection in the mill, shop, or field by the Engineer or by qualified inspectors selected by the Engineer and paid directly by the Owner.

B. However, such inspection, wherever conducted, shall not diminish truss fabricator's responsibility too provide his own inspection, testing, and quality control, and to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by Owner or Engineer if defects are discovered.

C. The truss fabricator shall give proper notice to inspection agencies designated by the Engineer and shall allow access and full facilities as required for this inspection.

1.7 DELIVERY, STORAGE AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1. For lumber treated with waterborne chemicals, sticker between each course to provide air circulation.

1.8 PROJECT CONDITIONS

A. Coordination - Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 PRODUCTS

2.1 GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Grade Stamps - Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing and mill.

a. Apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.

2. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

a. Provide dressed lumber, S4S, unless otherwise indicated.

b. Provide lumber with 19% maximum moisture content at time of dressing and shipment for sizes 2” or less in nominal thickness, unless otherwise indicated.

3. Wood nailers for roof shall conform to Factory Mutual's Loss Prevention Data Sheet 1-49.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals:

a. Alkaline copper quaternary (ACQ)

b. Chromated copper arsenate (CCA)

B. End Cut Preservative: Treat cut ends in accordance with manufacturer’s recommendations.

C. Adhesive: Use adhesives in accordance with manufacturer’s recommendations.

D. Kiln-dry preservative treated lumber and plywood panel material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

E. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

F. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Southern Yellow Pine No. 2 or better per SPIB rules

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated. No. 2 grade and any of the following species:

1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA

2. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA

3. Western woods; WCLIB or WWPA

2.4 MISCELLANEOUS LUMBER

A. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Hem-fir or Hem-fir (north), No. 2 Common grade; NLGA, WCLIB, or WWPA
2. Spruce-pine-fir (south) or Spruce-pine-fir, No. 2 Common grade; NELMA, NLGA, WCLIB, or WWPA
3. Eastern softwoods, No. 2 Common grade; NELMA
4. Northern species, No. 2 Common grade; NLGA
5. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture and compatible with the pressure treatment chemicals.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667

C. Power-Driven Fasteners: CABO NER-272

D. Wood Screws: ASME B18.6.1

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

I. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.6 PLYWOOD

A. Roof sheathing shall be APA rated, tongue and groove, exterior grade C-D, 3/4 inch thick plywood or as indicated on the Drawings.

B. Exterior wall sheathing shall be APA rated pressure treated, exterior, grade C-D, 1/2 inch thick plywood.

C. Interior exposed sheathing shall be APA rated, exterior, Type AA, and thickness as shown on Drawings.

2.7 FIBERGLASS LAMINATED PLYWOOD

A. Fiberglass lamination shall be 0.080 inch thick, white, with textured finish, and be substantially bonded to 3/4 inch thick exterior grade plywood.

B. Provide moldings and fasteners as recommended by the manufacturer

C. Submit color chart for selection by Owner.

D. Subject to compliance with this Section, acceptable manufacturers include:

1. Nudo Products, Inc., Springfield, IL

2. Kemlite Company, Joliet, IL

3. Sequentia, Inc., Lawrenceville, GA

4. or equal

2.8 ROOF TRUSSES

A. Roof Trusses shall be shop-fabricated wood trusses complete with hot dipped galvanized steel plate connectors, bridging, bracing and anchorage. They shall be designed, fabricated and installed by a manufacturer with a minimum of three years documented experience. The design of the trusses shall be under the direct supervision of a Professional Structural Engineer registered in the State of Connecticut. Design the truss in accordance with National Evaluation Service, Inc. Report No. NER-392 for a two-hour fire resistance rating over the chemical mix and storage room.

B. Materials

1. Wood members

a. The chord members shall be machine stressed rated (MSR) graded in accordance to the National Design Specifications for Wood Construction published by National Forest Products Association. The chord members shall have a minimum nominal size of 2 inch by 6 inch.

2. Steel Connector Plates shall be made from 18 gauge minimum Grade A ASTM A 446 class G90 hot dipped galvanized steel. Plates shall be applied to both faces of the truss at each joint.

a. Capacities of plate connectors in wood joints shall be determined in accordance with TPI Specifications.

b. Test connector plates with each species and grade of lumber to be used in truss fabrication.

C. Design Criteria - The roof trusses shall be designed for the following criteria.

1. Loading:

a. As specified on the Drawings.

2. Wind loading: comply with Connecticut State Building Code, most recent edition.

3. Deflections:-

   a. Live load deflections shall not exceed L/360 where L is the span of the building.

4. The wood truss shall be designed in accordance with Truss Plate Institute (TPI)-85 "Design Specification for Metal Plate Connected Wood Trusses" including supplement. The fabrication shall conform to QST: (TPI-85 Addendum, Appendix P) "Quality Standard for Metal Plate Connected Wood Trusses" and QSP-88 "Quality Standard for Plate Manufacture".

5. Stresses in members and forces in connections shall be determined for design purposes by rational analysis, in accordance with accepted engineering practice, including effects of stresses due to local eccentricities in joints, unless connections are detailed so that eccentricities do not exist.

6. In general, analysis shall assume compression and bending members to be unbraced unless special bracing is detailed or unless continuous bracing can reasonably be inferred from Drawings, in accordance with accepted engineering practice. Location and types of bracing required by analysis or assumed in design shall be indicated on Shop Drawings.

D. Trusses shall conform to approved Shop Drawings, including sizes, configurations, connector plates and other materials.

E. Joints shall be cut and fit accurately to bear wood to wood. Connector plates shall be undamaged, and shall be well embedded and accurately aligned so as not to introduce eccentricities into joints, unless such eccentricities are accounted for in analysis and design.

F. Splices shall be located only where indicated on approved Shop Drawings.

G. The shop drawings to be submitted shall have sizes and spacing of trusses, loads and truss cambers and framed openings. The design calculations shall be submitted to the Engineer along with the shop drawings. These submittals shall bear the seal of the Registered Professional Engineer supervising the preparation of them.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Cutting, framing and fitting shall be done as necessary for the accommodation of other work. The use of wood chips, shims, or other shrinkable material for leveling will not be permitted. Holes shall be bored accurately for bolts and as required to prevent splitting wood. Bolts shall be drawn up tight.

D. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

E. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

F. Select pressure treated members in accordance with appropriate untreated lumber and plywood span tables. Provide ventilation of building cavities as required by code.

G. Install pressure treated wood in accordance with requirements of applicable codes. Avoid milling operations that could adversely affect preservative characteristics of ACQ treated wood.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Connecticut State Building Code, most recent edition

2. CABO NER-272 for power-driven fasteners

3. Published requirements of metal framing anchor manufacturer

4. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code

5. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code

6. Table 2306.1, "Fastening Schedule," in the Standard Building Code

7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code

I. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD FURRING, GROUNDS, NAILERS, AND BLOCKING

A. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate location with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

D. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

E. Install treated wood nailers, blocking and plywood at locations indicated on Drawings.

F. Install continuous wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Drawings.

G. Contractor shall conduct pullout tests prior to start of nailer, blocking and plywood installation.

H. Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot in any direction. A 1/2 inch space shall be provided between nailer lengths. Individual nailer lengths shall not be less than 3 feet long. Nailer fastener spacing shall not exceed 12

inches on center. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches of each end. Nailer attachment shall meet this requirement and that of the current Factory Mutual Loss Prevention Data Sheet 1-49.

I. Thickness of nailers and woodwork shall be as indicated on Drawings to match substrate or insulation height to allow smooth transition.

J. Wood nailers and woodwork are generally indicated in nominal lumber sizes, where required, whether indicated or not, the roofing contractor shall furnish, ripped, continuous, plywood shims to create nailer heights to match conditions.

3.3 PLYWOOD

A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

B. Comply with "Code Plus" provisions in above-referenced guide.

3.4 ROOF TRUSSES

A. The wood trusses shall be installed in accordance with the manufacturer's instructions.

B. Trusses must be securely braced both during erection and after permanent installation in accordance with "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses (DSB-89)" published by the Truss Plate Institute, Inc. The members shall be set level and plumb and in correct position. Erection bracing shall be used to maintain them straight and plumb until decking and permanent truss bracing has been fastened forming a structurally sound roof framing system. Erection and permanent bracing shall be installed and securely fastened before application of any load.

C. Handling and installation shall follow the "Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses (HIB-91)" by TPI.

D. Attach trusses with an 18-gage minimum hurricane connector plate to the top plate at both ends of each truss, unless other connection is required by Drawings.

3.5 FIBERGLASS LAMINATED PLYWOOD

A. The fiberglass-laminated plywood shall be installed in accordance with the Massachusetts State Building Code, most recent edition, Section 2305.2.

3.6 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

END OF SECTION

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SECTION 06670

CELLULAR PVC FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Cellular PVC trim boards for corner boards, fascia, frieze, soffit, louvers, rake boards, architectural millwork and door / window trim.

B. Related Sections

1. Section 06100 – Rough Carpentry
2. Section 07620 – Sheet Metal Flashing and Trim
3. Section 07920 – Joint Sealants
4. Section 09900 – Painting

1.2 REFERENCES

A. The Connecticut State Building Code, Latest Edition

B. American Society for Testing and Materials (ASTM)

1. ASTM D792 – Density and Specific Gravity of Plastics by Displacement.
2. ASTM D570 – Water Absorption of Plastics.
3. ASTM D638 – Tensile Properties of Plastics
4. ASTM D790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D1761 – Mechanical Fasteners in Wood.
6. ASTM D5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by means of a Striker Impacted by a Falling Weight.
7. ASTM D256 – Determining the Pendulum Impact Resistance of Plastics.
8. ASTM D696 – Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous silica Dilatometer.
9. ASTM D635 – Rate of Burning and/or Extent of Time of Burning of Plastics in a Horizontal Position.
10. ASTM E84 – Surface Burning Characteristics of Building Materials.
11. ASTM D648 – Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
12. ASTM D3679 – Standard Specification for Rigid Poly Vinyl Chloride (PVC) Siding.

C. International Code Council Evaluation Service (ICC-ES):

1. AC227, Acceptance Criteria for Rigid Cellular PVC Non-Loadbearing Exterior Trim

D. International Organization for Standardization (ISO):

1. ISO/IEC 17065, Conformity Assessment – Requirements for Bodies Certifying Products, Processes and Services

1.3 SUBMITTALS

A. Product Data:

1. Submit product data and manufacturer's catalog for specified products.

B. Samples:

1. Submit three material samples representative of the texture, thickness and widths shown and specified herein.

C. Quality Control Submittals:

1. Current Evaluation Report demonstrating compliance with the latest edition of the Connecticut State Building Code. The Evaluation Report Provider shall be accredited by ANSI in accordance with ISO/IEC 17065. The Acceptance Criteria used as a prerequisite of acceptance for all cellular PVC trim shall be ICC-ES AC227.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Check with Local Building Code for installation requirements.

B. Allowance Tolerances:

1. Variation in component length: -0.00 / +1.00"

2. Variation in component width: ± 1/16"

3. Variation in component thickness: ± 1/16"

4. Variation in component edge cut: ±2°

5. Variation in density: -0% + 10%

C. Workmanship, Finish and Appearance

1. Free foam cellular PVC that is homogenous and free of voids, holes, cracks, and foreign inclusions and other defects. Edges must be square and top and bottom surfaces shall be flat with no convex or concave deviation.

2. Uniform surface free from cupping, warping, and twisting.

1.5 DELIVERY, STORAGE AND HANDLING

A. Trim materials should be stored on a flat and level surface on a full shipping pallet. Handle materials to prevent damage to product edges and corners. Store materials under a protective covering to prevent jobsite dirt and residue from collecting on the boards.

1.6 WARRANTY

A. Provide manufacturer's 25 year warranty against defects in manufacturing that cause the products to rot, corrode, delaminate, or excessively swell from moisture.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers:

1. Subject to compliance with requirements, provide products of one of the following:

a. AZEK Building Products, Inc., Moosic, PA

b. Certainteed Corporation, Valley Forge, PA

c. TUFBoard Building Products, Livingston, NJ

d. Or Equal.

2. Material: Free foam cellular PVC material with a small-cell microstructure and minimum density of .55 grams/cm^3.

a. When evaluated in accordance with the referenced ASTM test methods, material properties shall be as follows:

1) Density (ASTM D792): 0.55 g/cm^3 minimum.

2) Tensile Strength (ASTM D638): 1260 psi minimum.

3) Tensile Modulus (ASTM D638): 79400 psi minimum.

4) Flexural Strength (ASTM D790): 2000 psi minimum.

5) Flexural Modulus (ASTM D790): 110000 psi minimum.

6) Nail Hold (ASTM D1761): 35 Lbf/in of penetration minimum.

7) Screw Hold (ASTM (D1761): 485 Lbf/in of penetration minimum.

8) Coefficient of Linear Expansion (ASTM D696): $2.5x10^{-5}$ to $3.2x10^{-5}$ in/in/°F, inclusive.

9) Burning Rate (ASTM D635): No burning when flame is removed.

10) Flame Spread Index (ASTM E84): 25 maximum.

2.2 ACCESSORY PRODUCTS

A. Fasteners:

1. Use fasteners designed for wood trim and siding (thinner shank, blunt point, full round head), or use proprietary fasteners where required by trim manufacturer.

2. All fasteners shall be made from stainless steel.

3. Staples, small brads and wire nails shall not be used as fastening members.

4. Fasteners shall be long enough to penetrate a solid wood substrate a minimum of 1-1/2 inch (38 mm).

5. The use of standard nail guns is acceptable.

6. Use two fasteners per every framing member for trimboard applications. Use additional fasteners for trimboards 12 inches (305 mm) or wider, as well as sheets.

7. Install fasteners no more than 2 inches (51 mm) from the end of the board.

8. Fasten trim into a flat, solid substrate. Fastening trim into hollow or uneven areas must be avoided.

9. 3/8" and 1/2" sheet product shall not be ripped into trim pieces. Such profiles must be glued to a substrate and mechanically fastened.

B. Adhesives:

1. Glue all trim joints (scarf or miter) with a cellular PVC cement/adhesive. Use proprietary adhesives if required by the trim manufacturer.

2. Glue joints shall be secured with a fastener and/or fastened on each side of the joint to allow adequate bonding time.

3. Surfaces to be glued shall be smooth, clean and in complete contact with each other.

4. Various adhesives may be used. Consult adhesive manufacturer to determine suitability. Use of adhesives shall be governed by adhesive manufacturer's recommendations.

C. Sealants:

1. Use urethane, polyurethane or acrylic based sealants without silicone as specified in Section 07920.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify adequacy of backing and support framing.

C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 WORKMANSHIP AND INSTALLATION REQUIREMENTS

A. Comply with manufacturer's product catalog installation instructions and product technical bulletin instructions.

B. Work shall be free from machine and tool marks, abrasions, raised grain, or other defects on surfaces exposed to view.

C. Provide tight joints formed to conceal expansion and contraction.

D. Blind nail finish work to the greatest extent possible.

E. Secure work prevent to sagging, buckling or warping. Cellular PVC work shall be properly framed, closely fitted, and accurately set to the required lines and levels and shall be rigidly secured in place.

F. All cutting, drilling, milling, routing, sanding, grinding, and filing shall be performed in accordance with trim manufacturer's recommendations.

G. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

H. Set cellular PVC work to required levels and lines, with members plumb and true to line and cut and fitted.

I. Countersink nail heads on exposed cellular PVC work and fill holes with polyurethane or acrylic based caulk in color to match trim.

J. Install aluminum flashing behind all exterior trim at openings.

K. Miscellaneous Items: Install all required standing and running trim and other miscellaneous items throughout, as indicated on the Drawings and as required to satisfactorily complete the entire work, whether or not each and every required piece is specifically indicated on the Drawings. Trim shall be of same material and finish as the larger member to which applied.

3.3 PAINTING AND FINISHING

A. Field painting and finishing is specified under Section 09900 – Painting.

B. Sand all finish work at field joints and where required by installation. Leave work in perfect condition for finishing under Section 09900 – Painting.

3.4 COMPLETION

A. Just prior to completion of work of this Section, inspect work in the company of the Owner and make adjustments and corrections to work leaving operating parts in perfect operating condition, all jointing to adjacent material tight, all surfaces without blemishes or stains, all work properly executed and complete, and all defects and damaged work replaced or corrected.

END OF SECTION

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SECTION 07210

BUILDING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Board-type building insulation

2. Board-type insulation at perimeter foundation walls and underside of floor slabs

1.2 REFERENCES

A. ASTM C578

B. ASTM C665

C. ASTM C764

D. ASTM E96

1.3 SUBMITTALS

A. Product Data - Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

1.4 QUALITY ASSURANCE

A. Thermal Resistivity - Where thermal resistivity properties of insulation materials are designated by R-values they represent the rate of heat flow through a homogenous material exactly 1 inch thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperature indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General Protection - Protect insulations from physical damage from handling, weather, and construction operations before, during, and after installation. Protect insulations from becoming wet, soiled, or covered with ice or snow.

1. Comply with manufacturer's recommendations for handling, storage and protection during installation.

2. Protect against ignition at all times. Do not deliver insulating materials to project site ahead of installation time.

B. Protection for Plastic Insulation

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Complete installation and concealment of plastic materials as rapidly as possible in each area of work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. Extruded Polystyrene Board Insulation for Foundations and Slabs

a. Amoco Foam Products Co.

b. Dow Chemical U.S.A.

c. Owens-Corning

d. Or equal

2. Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

a. Dow Chemical U.S.A.

b. CELOTEX

c. Or equal

2.2 INSULATING MATERIALS

A. General - Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

1. Preformed Units - Sizes to fit applications indicated, selected from manufacturer's standard thickness, widths and lengths.

2. Where thermal resistance (“R” value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.

B. Extruded Polystyrene Board Insulation - Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 Type IV. Aged 5-year R-values of 5.4 and 5 at 40ºF and 75ºF (4.4 and 23.9ºC) per inch, respectively; and as follows:

1. Density: 1.6 lbs per cu. ft. minimum.

2. Compressive Strength: 25 psi minimum.

C. Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

1. Insulation board shall be rigid glass fiber-reinforced polyisocyanurate foam board covered with embossed aluminum facing on both sides.

2. Insulation board facing shall have a water permeance (perm) rating of 0.03 when tested in accordance with ASTM E96.

3. Insulation board shall have a flame spread rating of 25 or less and smoke development rating of less than 90 per ¾-inch thickness of insulation.

4. Thermal resistance of insulation shall not be less than the R-values indicated on the drawings.

2.3 AUXILIARY INSULATING MATERIALS

A. Provide insulation fasteners, anchors, plates, washers, standoffs, hangers and like accessories recommended by the insulation manufacturer for the secure installation of insulating materials.

B. Adhesive for Bonding Insulation - Type recommended by insulation manufacturer, and complying with requirements for fire performance characteristics.

C. Crack Sealer for Board Insulation - Provide polymeric insulating foam in aerosol dispenser designed for filling voids in board insulation.

D. Polyethylene Vapor Retarder - 6-mil polyethylene film, with laboratory-tested vapor transmission rating of 0.2 perms, natural color.

E. Wire Mesh - Galvanized steel, hexagonal wire mesh.

PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION

A. Require Installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Contractor shall obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

B. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections which might puncture vapor retarders.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Extend insulation full thickness as shown over entire are to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projects, which interfere with placement.

3.3 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

B. Install insulation 4 feet min. below the first floor slab against the perimeter foundation wall or as shown on the Drawings and 2 feet from the perimeter wall against the first floor slab, unless otherwise shown on the Drawings.

3.4 WALL INSULATION

A. Exterior Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

1. Insulation board shall be rigid glass fiber-reinforced polyisocyanurate foam board covered with embossed aluminum facing on both sides.

B. the fiberglass blanket plus 2 flanges, each 2" wide (see also Part B of this Section). The innermost blanket against the interior wall panel shall be faced.

C. Retain insulation in place with wire mesh secured to framing members, where indicated. Tape seal tears or cuts in vapor retarder.

3.5 PROTECTION

A. General - Protect installed insulation from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

END OF SECTION

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SECTION 07310

SHINGLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Granule surfaced asphalt shingle roofing
2. Moisture shedding underlayment, eaves, valley and ridge protection
3. Associated metal flashing
4. Ridge Vent
5. Soffit Vent

B. Related Sections

1. Section 06100 - Rough Carpentry
2. Section 07620 - Sheet Metal Flashing and Trim

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A653 / A653M – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. B209 – Aluminum and Aluminum-Alloy Sheet and Plate.
3. B370 – Copper Sheet and Strip for Building Construction.
4. D226 – Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
5. D1970 – Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
6. D3462 – Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
7. D4586 – Asphalt Roof Cement, Asbestos-Free.

B. International Organization for Standardization (ISO)

1. ISO/IEC Guide 65, General Requirements for Bodies Operating Product Certification Systems

C. Underwriter's Laboratories (UL)

1. UL 790 - Tests for fire resistance of roof covering materials.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheet for each product to be used, including:

1. Shingles, underlayment, flashings, fasteners, and accessories indicating composition, properties, and dimensions. Provide data showing compliance with specified requirements.

2. Installation instructions indicating preparation required and installation procedures.

3. Storage and handling requirements and recommendations.

B. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and surface textures.

C. Verification Samples: For each finish product specified, two samples, representing actual product, color, and texture.

D. Quality Control Submittal:

1. Current Evaluation Report (ER) demonstrating compliance with the latest edition of the Connecticut State Building Code. The ER shall be produced by ICC-ES or another ER Provider accredited by ANSI in accordance with ISO/IEC Guide 65.

1.4 QUALITY ASSURANCE

A. Manufacturer - obtain shingles from a single manufacturer and from a single lot to ensure uniform color.

B. Maintain one copy of manufacturer's application instructions on project site.

C. Verify that manufacturer's label contains reference to specified ASTM standards.

D. Installer - a firm with not less than 3 years experience successfully installing roofs of a similar type.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials with manufacturer's labels intact and legible.

B. Deliver materials with Underwriter's Laboratories, Inc., labels.

C. Store materials on raised platforms and protect from weather with coverings at outdoor locations.

D. Do not stack bundles of shingles more than 4 feet high.

E. Do not break up bundles until shingles are ready to be applied to roof.

1.6 EXTRA MATERIALS

A. Supply 33 sq. ft. of extra shingles selected.

1.7 PROJECT CONDITIONS

A. Weather - Proceed with roofing work only when existing and forecast weather conditions will permit work to be performed in accordance with the manufacturer's recommendations and guarantee requirements.

1.8 WARRANTY

A. Shingle Manufacturer’s 30- year material warranty

1. Upon successful completion of the Work and receipt of final payment, the shingle manufacturer’s 30-year material warranty shall be issued to the Owner.

B. Roofing Contractor’s two-year labor and workmanship warranty

1. The roofing contractor shall supply the Owner with a minimum two-year workmanship warranty. In the event any Work related to roofing, flashings, or metal work is found to be defective or otherwise not in accordance with the Contract Documents within two years of Substantial Completion, the roofing contractor shall remove and replace at no cost to the Owner. The Contractor’s warranty obligation shall run directly to the Owner and a copy shall be sent to the shingle manufacturer. This warranty shall not limit the Contractor’s obligation with respect to State or Government laws or statutes.

PART 2 PRODUCTS

2.1 ROOF SHINGLES

A. Provide asphalt shingles conforming to ASTM D3462, UL 790 Class A, Organic Felt or Fiberglass Mat Base, Mineral Granule surface type.

B. Shingles shall be XT25 Asphalt Shingles by Certainteed, Royal Sovereign Asphalt Shingles by GAF, Elite Glass-Seal Asphalt Shingles by Tamko, Supreme AR Asphalt Shingles by Owens-Corning, or equal. Color and style to be selected by the Engineer and coordinated with the Owner.

2.2 ASPHALT FELT SHINGLE UNDERLAYMENT

A. Provide asphalt - saturated organic felt underlayment conforming to ASTM D226.

2.3 ICE DAM PROTECTION ROOFING UNDERLAYMENT

A. Provide a self adhering, self sealing roofing underlayment along each eave conforming to ASTM D1970.

2.4 ACCESSORIES

A. NAILS

1. Standard ring barbed hot dipped galvanized roofing type nails, minimum 7/16-inch head diameter and 0.08 shank diameter of sufficient length to penetrate through roof sheathing.

2. Aluminum nails shall be used to secure aluminum flashing and drip edge.

B. Asphalt Roofing Cement: ASTM D4586, Type I or II.

2.5 FLASHING MATERIALS

A. Sheet Flashing: ASTM A653/A653M; 26 gage (0.45 mm) steel with minimum G115/Z350 galvanized coating.

B. Sheet Flashing: ASTM B209; 0.025 inch (0.63 mm) thick aluminum, mill finish.

C. Sheet Flashing: ASTM B370; cold rolled copper; 16 ounces per square foot (0.55 mm); natural finish.

D. Bituminous Paint: Acid and alkali resistant type; black color.

E. Tinner's Paint: Color as selected by Engineer to coordinate with shingle color.

2.6 FLASHING FABRICATION

A. Form flashing to profiles indicated on Drawings, and to protect roofing materials from physical damage and shed water.

B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

2.7 RIDGE VENT

A. Ridge vent shall be virgin, high density, linear polyethylene, UV inhibited.

B. Ridge vent shall have wind baffles and a weather filter.

C. Each plug shall be closed cell polyurethane foam.

D. Dimensions – 20' long x 12" wide x 1-3/8" high.

E. Ridge vent thickness - 0.08".

F. Net Free Area - 18 square inches per linear foot.

G. Ridge vent shall be Shinglevent II, as manufactured by Airvent, or equal.

2.8 SOFFIT VENT

A. Soffit vent shall be constructed of 3005-H25 aluminum sheet or equivalent. Minimum tensile strength shall be 26,000 psi. Minimum yield strength shall be 22,000 psi.

B. Color to match that of existing soffit.

C. 12 sq. in. of net free area per linear foot shall be provided by vent.

D. Ventilation provided by the soffit vent shall be in conformance with the Connecticut State Building Code.

2.9 ALUMINUM DRIP EDGE

A. Minimum .024" aluminum sheet style-D drip edge, brake-formed to provide a minimum 1¼" inch flange with 3/8" drip at lower edge by minimum 6 1/2" roof deck flange. Furnish in 8' or 10' lengths. Do not install drip edge in pieces shorter than 24". Color to be selected by Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions

1. Assure that surfaces to which shingles are to be applied are uniform, smooth, sound, clean, dry and free from irregularities.

2. Verify that deck surfaces are dry, free of ridges, warps and voids.

3. Verify that Work of other trades that penetrate the roof deck has been completed.

4. Do not start Work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Ice dam protection roofing underlayment

1. Place eave edge and gable edge metal flashing tight with fascia boards. Weather-lap joints 2 inches (50 mm). Secure flange with nails spaced 8 inches (200 mm) on center.

2. Apply ice dam waterproofing membrane shingle underlayment as eave protection in accordance with manufacturer's instructions.

3. Extend eave protection membrane minimum 24 inches projected horizontally beyond interior face of exterior wall.

4. Roof slope 4:12 or greater: Install one layer asphalt felt shingle underlayment perpendicular to slope of roof and lap minimum 4 inches over eave protection.

B. Roof shingles

1. Install shingles in accordance with manufacturer's instructions.

2. Use a minimum of four nails per shingle.

3. Nail heads shall be flush with shingle surface. Do not drive nail heads into shingles.

4. The shingles shall be underlayed with 15 lb. roofing felt, meeting ASTM D226, Type I.

a. The roofing felt shall be lapped 2 inches horizontally with 4 inch end laps staggered. Lap underlayment 6 inches from both sides over ridges. Secured roofing felt with sufficient fasteners to hold it in place until shingles are applied.

5. Place shingles in straight coursing pattern with 5” weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

6. Project first course of shingles 3/4” beyond metal drip edge.

7. Extend shingles 1/2” beyond gable metal drip edge.

8. Cap ridge with individual shingle sections, maintaining 5” weather exposure. Place to avoid exposed nails.

C. Metal flashing

1. Weather-lap joints minimum 2 inches.

2. Seal work projecting through or mounted on roofing with asphalt roofing cement and make weather-tight.

D. Coordinate installation of roof mounted components of work projected through roof with weather tight placement of flashing and counter flashing.

E. Install soffit vents per manufacturer's recommendations.

F. Complete installation to provide weather tight vented roof system.

3.3 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished roof surface.

END OF SECTION

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SECTION 07463

FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Siding panels.
2. Fascia and soffit panels.
3. Door, louver & corner trim.
4. Trim panels for lights, electrical panels, receptacles, and piping penetrations.
5. Accessories and miscellaneous trim.

B. Related Sections:

1. Section 06100 – Rough Carpentry
2. Section 06670 – Cellular PVC Fabrications
3. Section 07620 – Sheet Metal Flashing
4. Section 07920 – Joint Sealants
5. Section 09900 – Painting
6. Section 13121 – Precast Concrete Building

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C920, Standard Specification for Elastomeric Joint Sealants.
2. C1186, Standard Specification for Flat Fiber Cement Sheets.
3. D2244, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

B. International Code Council Evaluation Service (ICC-ES):

1. AC90, Acceptance Criteria for Fiber Cement Panels Used as Exterior Wall Siding

C. International Organization for Standardization (ISO):

D. ISO/IEC Guide 65, General Requirements for Bodies Operating Product Certification Systems

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheet for each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

3. Installation methods, including nailing patterns.

B. Samples for Initial Selection: For siding and related accessories, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch-long-by-actual-width Sample of siding.

2. 12-inch-long-by-actual-width Samples of trim and accessories.

D. Maintenance Data: For each type of siding and related accessories to include in maintenance manuals.

E. Quality Control Submittal:

1. Current Evaluation Report demonstrating compliance with the latest edition of the Connecticut State Building Code. The ER Provider shall be accredited by ANSI in accordance with ISO/IEC Guide 65. The Acceptance Criteria used as a prerequisite of acceptance for fiber cement siding shall be ICC-ES AC90.

F. Warranty: Sample of manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

B. Source Limitations: Obtain each type, color, texture, and pattern of siding, including related accessories and trim, from single source from single manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in manufacturer's original packaging until ready for installation.

B. Prior to application, siding and accessories are to be stored in an area that is clean, dry, level and out of direct sunlight. Do not store in location where temperatures may exceed 130 degrees F.

C. Handle material in a manner to prevent damage. Do not allow siding cartons to crease.

1.6 WARRANTY

A. Warranty: Standard form in which manufacturer warranties siding and soffit against manufacturer's defects, and agrees to repair or replace defective materials within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural defects, including cracking and deforming.

b. Finish defects, including peeling, cracking, chipping and fading.

2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 4 Hunter color-difference units as measured according to ASTM D 2244.

3. Warranty Period: 30 years for siding and 25 years for soffit (15 years for finishes) from date of Substantial Completion.

4. Workmanship warranty: Application limited warranty for 2 years.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

A. General: Integrally textured, cellulose fiber cement board made under high pressure, with a factory applied sealing system, complying with ASTM C1186, Type A, Grade II.

1. Basis-of-Design Product: Subject to compliance with requirements, provide "HardiePlank HZ5 lap siding" by James Hardie Building Products, Inc.; or a comparable product by one of the following:

a. Certainteed Corp.

b. Nichiha USA, Inc.

c. or approved equal.

B. Thickness: 5/16 inch ± 0.04 inch.

C. Style and factory finish to be selected by Owner from manufacturer's full range of available options.

2.2 SOFFIT

A. General: Ventilated and non-ventilated, with a factory applied sealing system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide "HardieSoffit HZ5" by James Hardie Building Products, Inc.; or a comparable product by one of the following:

a. Certainteed Corp.

b. Nichiha USA, Inc.

c. or approved equal.

B. Thickness: ¼ inch ± 0.04 inch.

1. Style and factory finish to be selected by Owner from manufacturer's full range of available options.

2.3 ACCESSORIES

A. Trim: Made from same material as adjacent siding, with factory applied sealing system.

1. Provide starter strips for lap siding, outside corners butted to siding, outside corners overlapping siding, fascia board, and other items as recommended by siding manufacturer for building configuration.

B. Sealant: Paintable, 100% acrylic latex caulk, complying with ASTM C920 and specification section 07920.

C. Sheet Metal Flashing: Provide sheet metal flashing and trim in accordance with specification section 07620

D. Nails: Length as required to penetrate minimum 1-1/4 inch into solid backing; hot-dipped galvanized or stainless steel.

E. Building paper: Kraft or bituminous. Do not use polyethylene or foil.

F. Touch-Up Paint Kit: Provide manufacturer's touch-up kit for each color provided.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding, soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Read warranty and comply with all terms necessary to maintain warranty coverage.

2. Touch up all field cut edges before installing.

3. Do not install damaged components.

4. Pre-drill nail holes if necessary to prevent breakage.

B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing, into studs.

C. Allow space between both ends of siding panels that butt against trim for thermal movement; seal joint between panel and trim in accordance with Division 07 Section "Joint Sealants."

D. Except at corners, avoid joints in lap siding. Where joints are inevitable, stagger joints between successive courses.

E. Install sheet metal flashing above door casings and horizontal trim in field of siding.

F. Do not install siding:

1. Less than 6 inches from ground level,

2. Closer than 1 inch to roofs, patios, and other surfaces where water may collect.

G. After installation, seal all joints except lap joints of lap siding. Seal around all penetrations.

H. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.

I. Paint all exposed cut edges.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Exposed trim and fascia
2. Metal flashing
3. Downspouts and gutters
4. Copings

B. Related Sections

1. Section 06100 – Rough Carpentry

1.2 REFERENCES

A. The State of Connecticut Building Code, Latest Edition.

B. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C. ASTM B32 – Standard Specification for Solder Metal

D. ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

E. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

F. AAMA 605.2 – Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

G. FS UU-B-790 Federal Specification: Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

H. SMACNA – Sheet Metal and Air Conditioning Contractors' National Association

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Fabricate and install flashings at roof edges to comply with requirements of recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone, whichever is more stringent:

1. Wind Zone 1: Wind pressures of 31 to 45 psf

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specifications.

B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include sample sets composed of 2 or more units showing the full range of variations expected.

1. 8-inch square samples of specified sheet materials to be exposed as finished surfaces.

2. 12-inch long samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

D. Qualification data for firms and persons to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer with 10 years of experience and who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:

1. Aluminum Sheet: ASTM B209, 3003-H14, with a minimum thickness of 0.060 inch, unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: ASTM B32, Grade Sn50, used with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other non-corrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat

D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant

E. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants"

F. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints

G. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal

H. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

I. Polyethylene Underlayment: ASTM D4397, minimum 6-mil thick black polyethylene film, resistant to decay when tested according to ASTM E154.

J. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; non-corrosive; size and thickness required for performance

2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

F. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

H. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, non-corrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Leaders and Downspouts: Fabricate from the following material:

1. Aluminum: 0.032 inch thick

C. Exposed Trim, Gravel Stops, and Fascia: Fabricate from the following material:

1. Aluminum: 0.060 inch thick

D. Base Flashing: Fabricate from the following material:

1. Aluminum: 0.060 inch thick

E. Counterflashing: Fabricate from the following material:

1. Aluminum: 0.060 inch thick.

F. Through-wall Flashing: Fabricate from the following material:

1. Aluminum: 0.060 inch thick.

G. Flashing Receivers: Fabricate from the following material:

1. Aluminum: 0.060 inch thick.

2.5 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

B. High-Performance Organic Coating Finish: AA-C12C42R1x Organic Coating (as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

a. Color and Gloss:

1) Aluminum Fascia: Match existing fascia

2) Aluminum Downspouts: Match existing fascia

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof-Edge Flashings: Secure metal flashings at roof edges in accordance with performance requirements specified in Section 1.3.B.

D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in finished Work.

1. Do not solder the following metals:

a. Aluminum.

2. Pretinning is not required for the following metals:

a. Lead-coated copper.

3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams:

1. Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2. Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.

2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

I. Reglets: Install reglets to receive counterflashing according to the following requirements:

1. Where reglets are shown in masonry, furnish reglets for installation under Section 04810, Unit Masonry Assemblies.

J. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

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SECTION 07920

JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

a. Perimeter joints between materials listed above and frames of doors, windows and louvers

b. Other joints, as indicated

2. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

a. Perimeter joints between interior wall surfaces and frames of interior doors and windows

b. Other joints as indicated

3. Exterior joints in horizontal traffic surfaces as indicated below:

a. Joints in concrete sidewalks

b. Other joints as indicated

B. Related Sections

1. Section 03300 - Cast-in-Place Concrete

2. Section 08110 - Steel Doors and Frames

3. Section 08510 - Steel Windows

4. Section 13121 – Precast Concrete Building

1.2 REFERENCES

A. ASTM C717 - Standard Terminology of Building Seals and Sealants

B. ASTM C719 - Standard Test Method for Adhesion Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle)

C. ASTM C834 - Standard Specification for Latex Sealants

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants

F. ASTM C1193 - Standard Guide for Use of Joint Sealants

G. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stop

I. Underwriters Laboratories, Inc.

1.3 PERFORMANCE

A. Provide joint sealants that have been produced and installed to establish and maintain watertight and air tight continuous seals.

1.4 SUBMITTALS

A. Submit Product Data from manufacturers for each joint sealant product required, including instructions for joint preparation and joint sealant application.

B. Submit samples for Initial Selection Purposes - Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.

C. Submit samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in ½-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealant.

D. Submit certificates from manufacturers of joint sealants attesting that their products comply with Specification requirements and are suitable for use indicated.

E. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Engineers and Owners, plus other information specified.

F. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

G. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications - Company specializing in performing the work of this Section who has successfully completed within the last 3 years at least 3 joint sealant applications similar in type and size to that of this Project.

B. Single Source Responsibility for Joint Sealant Materials - Obtain joint sealer materials from a single manufacturer for each different product required.

C. All sealants shall be used as received from the manufacturer and no thinning or other alterations will be allowed at the job site.

D. Preconstruction Compatibility and Adhesion Testing - Submit samples of all materials that will contact or affect joint sealants to joint sealant manufacturers for compatibility and adhesion testing, as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under normal environmental conditions that will exist during actual installation.

2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.

4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above which is acceptable to the Engineer and is based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

E. Product Testing - Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of submittal of test results.

1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modules of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.

a. Include test results performed on joint sealers after they have cured 1 year.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions - Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40ºF (4.4ºC).

2. When joint substrates are wet due to rain, frost, condensation or other causes.

B. Joint Width Conditions - Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions - Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Sequencing installation of joint sealers to occur not less than 21 or more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility - Provide joint sealants that are compatible with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors - Provide color of exposed joint sealants as selected by the Engineer from manufacturer's standard colors.

2.2 SEALANT - SUBMERSION AND TRAFFIC SURFACE APPLICATION

A. The sealant to be used for this work shall be a polyurethane-base, non-sag elastomeric sealant with underwater primer.

1. The sealant shall be approved for potable water contact by a certified testing laboratory.

2. The sealant shall conform to Federal Specifications TT-S-00227E, Class A, Type II; ASTM C920, Type M, Grade NS, Class 25.

3. The sealant shall exhibit inherent adhesion, which will not migrate in time.

4. The sealant shall withstand total movement up to 25% extension and 25% compression.

5. Unless otherwise directed, sealant color shall be manufacturer's standard color, which matches most closely the color of the material being jointed.

6. The sealant shall be Sikaflex 2c NS EZ Mix as manufactured by Sika Corporation or equal.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard - Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those referenced for Type, Grade, Class and Uses.

1. 50% movement in both extension and compression for a total of 100% movement.

B. One-Part Nonacid-Curing Silicone Sealant - Type S - Grade NS - Class 25 - and complying with the following requirements for uses and additional joint movement capability.

1. Uses T, NT, M, G, A, and as applicable to joint substrates indicated, O.

2. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719 to withstand the following, percentage increase and decrease of joint width as measured at time of application and remain in compliance with other requirements of ASTM C920 for uses indicated.

a. 100% movement in extension and 50% movement in compression for a total of 150% movement.

C. Products - Subject to compliance with requirements, provide one of the following:

1. One-Part Nonacid-Curing silicone Sealant:

a. Silpruf SCS 2000 - General Electric Co.

b. 864 - Pecora Corp.

c. Spectrem 1 - Tremco, Inc.

d. Spectrem 2 - Tremco, Inc.

e. or equal.

2.4 JOINT SEALANT BACKING

A. General - Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers - Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nonglassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Either open cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

C. Elastomeric Tubing Joint-Fillers - Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26°F (-15°C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape - Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer - Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaners for Nonporous Surfaces - Provide nonstaining, chemical cleaners of type which are acceptable to manufacturer of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oil residues or otherwise have detrimental effect on a sealant adhesion or in-service performance.

C. Masking Tape - Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

D. Accessory Materials for Fire-Stopping Sealants - Provide forming, joint-fillers, packing and other accessory materials required for installation of fire-stopping sealants as applicable to installation conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints - Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturers and the following requirements.

1. Remove all foreign material from joint substrates, which could interfere with adhesion of joint sealant.

2. Clean concrete joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other nonporous surfaces by chemical cleaners or other means, which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming - Prime joint substrates as recommended by joint sealant manufacturer. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape - Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General - Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard - Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings - Install sealant backings to comply with the following requirements:

1. Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths, which allow optimum sealant movement capability.

a. Do not leave gaps between ends of joint-fillers.

b. Do not stretch, twist, puncture or tear joint fillers.

c. Remove absorbent joint fillers, which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint fillers, compression seals or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.

3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

D. Installation of Sealants - Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants - Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform bends of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Do not use tooling agents, which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

JOINT SEALER SCHEDULE

Joint Sealants	Description of joint construction and location where sealant is typically applied (see note below).
Non-sag Elastomeric Sealant with Underwater Primer	All submerged joints and traffic surfaces.
One-Part Non-Acid Curing-Silicone Sealant	Exterior and interior joints in horizontal and vertical surfaces of concrete and masonry; between concrete masonry; between metal and concrete, mortar; perimeters of metal frames in exterior walls; overhead or ceiling joints; horizontal joints and foundation joints in vertical wood siding; joints where vertical wood siding adjoins concrete.

Provide a joint seal at all joints subject to weather infiltration whether shown or scheduled. Joints not shown or scheduled shall receive a joint sealant as selected by the Engineer from the sealants listed above.

END OF SECTION

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SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Hollow metal doors and frames

B. Related Sections

1. Section 08710, Door Hardware – Templates for hardware, reinforcing and cut-outs in doors and frames and the furnishing of all hardware.

2. Section 09900, Painting – Finish painting of doors and frames.

1.2 REFERENCES

A. ANSI A250.8 (Formerly SDI-100) – Recommended Specifications for Standard Steel Doors and Frames

B. Steel Door Institute (SDI-105) – Recommended Erection Instruction for Steel Frames

C. Door and Hardware Institute – Recommended Locations for Builder's Hardware

D. ANSI A115 – Specification for Door and Frame Preparation for Hardware

E. ASTM A90 – Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings

F. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

G. ASTM A568 – Standard Specification for Steel, Sheet, Carbon and High-Strength, Low Alloy, Hot-Rolled Sheet and Cold-Rolled Sheet

H. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

I. ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled Carbon, Structural, High Strength Low-Alloy and High Strength Low Alloy with Improved Formability

J. ASTM A1011 – Standard Specification for Steel, Sheet and Strip – Hot Rolled, Carbon Structural, High Strength Low-Alloy and High Strength Low Alloy with Improved Formability

K. ASTM C1363 – Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Guarded Hot Box

L. ASTM E2074 – Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side Hinged and Pivot Swinging Door Assemblies

M. NFPA 80 – Standard for Fire Doors and Windows

1.3 SUBMITTALS

A. Product Data – Submit manufacturer's technical product data substantiating that products comply with these requirements.

B. Shop Drawings – Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

1. Provide schedule of doors and frames using same reference number for details and openings as those on Contract Drawings.

2. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI A250.8 and as specified in this section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work in cartons or crates to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Engineer; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove carton immediately. Provide ¼ inch spaces between stacked doors to promote air circulation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer – Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products

2. Curries Mfg., Inc.

3. E.H. Frederick Co.

4. The Philipp Manufacturing Co.

5. Pioneer Industries, Inc.

6. or equal.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip – Commercial quality carbon steel, pickled and oiled, complying with ASTM A1011 and ASTM A568.

B. Cold-Rolled Steel Sheets – Commercial quality carbon steel, complying with ASTM A1008 and ASTM A568.

C. Galvanized Steel Sheets – Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A90 and ASTM A653, G60 zinc coating, mill phosphatized.

D. Supports and Anchors – Fabricate of not less than 18 – gauge galvanized sheet steel.

E. Inserts, Bolts and Fasteners – Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A153, Class C or D as applicable.

2.3 STEEL DOORS AND FRAMES FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI A250.8 Level 3, extra heavy-duty, Model 3 or 4, minimum 16-gauge faces for doors and 14 gauge for frames.

B. Fabricate frames, concealed stiffeners reinforcement, edge channels and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).

C. Fabricate doors, panels, and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gauge inverted steel channels.

D. Exposed Fasteners – Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

E. Thermal-Rated (Insulating) Assemblies – Provide doors which have been fabricated as thermal insulating door and frame assemblies and tested in accordance with ASTM C236.

1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.24 Btu/(hr. x ft^2 x ºF)

F. Fire-Rated Door Assemblies – Where fire-rated door assemblies are indicated or required, provide fire-rated door and assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E2074 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

G. Finish Hardware Preparation – Prepare doors and frames to receive mortised and concealed finish hardware in accordance with Section 08710 and final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

I. Locate finish hardware as indicated on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware", published by the Door and Hardware Institute.

2.4 STANDARD STEEL FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 14-gauge cold-rolled furniture steel. Fabricate frames with mitered and welded corners.

B. Door Silencers – Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.

C. Plaster Guards – Provide 26-gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.5 SURFACE PREPARATION AND PAINTING

A. Surface preparation and prime painting is provided under this Section. Prime paint shall conform to the requirements and be of the same manufacturer as that provided under Section 09900 – Painting. Coordinate prime painting with the Painting contractor. Finish painting is included under Section 09900.

PART 3 EXECUTION

3.1 INSTALLATION

A. General – Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames – Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames", unless otherwise indicated.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. At concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
3. Install fire-rated door frames in accordance with NFPA Std. No. 80.

C. Door Installation

1. Fit hollow metal doors accurately in frames, within clearances specified in ANSI A250.8.
2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-up – Immediately after erection, touch-up prime coat as specified in Section 09900 – Painting.

B. Protection Removal – Immediately prior to final inspection, remove protection plastic wrappings from prefinished doors.

C. Final Adjustments – Check and re-adjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating conditions.

END OF SECTION

SECTION 08310

ACCESS HATCHES AND PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Hatches and frames
2. Single door hatches and frames
3. Double door hatches and frames

B. Related Sections

1. Section 03300 - Cast-in-Place Concrete
2. Section 03320 – Precast Concrete Plank
3. Section 09900 - Painting

1.2 REFERENCES

A. ASTM A36 – Standard Specification for Carbon Structural Steel

B. OSHA 29 CFR Part 1910.27 – Fixed Ladders

1.3 SUBMITTALS

A. Product Data - Submit manufacturer's product data, roughing in diagrams, and installation instructions for each type and size of hatch. Provide operating instructions and maintenance information.

B. Shop Drawings - Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets.

1.4 HANDLING

A. Deliver materials in manufacturer’s original packaging.

B. Store materials in a dry, protected, well-vented area. Thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier’s freight bill of lading.

C. Remove protective wrapping immediately after installation (if applicable).

1.5 JOB CONDITIONS

A. Verify that other trades with related work are completed before installation.

B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.

C. Coordinate installation with other trades before starting.

1.6 WARRANTY/GUARANTEE

A. Manufacturer’s standard warranty: Materials shall be free of defects in material and workmanship for a period of 5 years from the date of substantial completion.

1.7 QUALITY ASSURANCE

A. Castings shall be smooth, free of blowholes, and imperfections. Hinges and latches shall act freely and without binding.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. The Bilco Company; New Haven, CT

B. Milcor, Inc.; Lima, OH

C. U.S.F. Fabrication; Hialeah, FL, or

D. Approved equal.

2.2 HATCHES - GENERAL

A. Where indicated on the Drawings, provide prefabricated floor hatches.

B. Steel shall comply with ASTM A36.

C. Door leafs shall be ¼-inch galvanized steel with diamond plate cover. Frame shall be ¼ inch thick galvanized steel angle with 1 inch by 4 inch anchors welded at 18 inches on center or as per manufacturer's recommendation.

D. Doors shall be equipped with stainless steel tamper proof hinges and 5/16 inch diameter minimum stainless steel pins.

E. Hinges, latches, hasps, handles and all miscellaneous hardware shall be stainless steel.

F. Hatch shall be coated with a bitumastic coating at all locations coming in contact with concrete.

G. Door lock shall be operable from both sides of the hatch. Provide a snap lock with removable handle.

H. Doors shall be equipped with flush stainless steel drop handle that does not protrude above the cover.

I. Doors shall be equipped with an automatic hold-open arm complete with vinyl grip handle to permit easy one hand release.

J. The hatch surface shall be smooth as to not cause a tripping hazard.

K. The hatches shall be furnished with one coat of shop primer.

L. All hooks, anchor bolts, angles and all miscellaneous hardware shall be Type 316 stainless steel.

M. The hatch shall be watertight.

N. The hatch shall be equipped with a retractable handrail.

O. Hatches shall be equipped with a push bar for emergency exit.

P. Hatches shall be rated for AASHTO H-20 loading.

Q. Hatches shall be rated for a 300-psf live load.

2.3 WET WELL HATCH

A. Comply with the general specifications and the following.

B. Single leaf door.

C. Hatch shall be reinforced and rated for 300 psf loading with maximum deflection of L/150 of the span.

D. The frame shall be fabricated from ¼ inch galvanized steel to a channel shape that shall drain water out through a 1½ inch pipe coupling.

E. The hatch shall be watertight.

2.4 SAFETY CLIMB DEVICE

A. General:

1. Shall conform to OSHA 29 CFR Part 1910.27.

2. Belt and harness shall withstand minimum drop test of 250 pounds in 6 foot free fall.

3. Fall Prevention System Material: Aluminum 6061-T6.

4. Provide at the wet well and valve vault.

B. Components and Accessories:

1. Main Components: Sleeve or Trolley, Safety Harness, and Carrier or Climbing Rail.

2. Ladder rung clamps with aluminum mounting brackets and hardware.

3. Removable extension kit with tiedown rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

C. Manufacturers and Products:

1. North Safety Products, Specialty Products Division, Toronto, Ontario, Canada; Saf-T-Climb Fall Prevention System.

2. Miller Equipment, Franklin, PA; Sure Track Rail System.

3. TS Products, St. Charles, IL; TS Safety Rail System.

2.5 SAFETY NET

A. All hatches shall be provided with a safety net fall through prevention system. Net shall be made of heavy duty polyester, with a minimum breaking strength of 5,000 pounds. All hooks, anchor bolts, angles and all miscellaneous hardware shall be type 316 stainless steel.

2.6 HATCH SCHEDULE

Location	Size	Quantity
Wet Well	42″ x 60″	1
Valve Vault	36″ x 48″	1

PART 3 EXECUTION

3.1 FIELD INSTALLATION

A. Hatches shall be installed where indicated in accordance with manufacturer's printed instructions and approved submittals.

B. Wet Well and valve vault hatches shall be cast into concrete. Coordinate with the requirements of Section 03300.

C. Hatches shall be free from binding.

3.2 SURFACE PREPARATION AND PAINTING

A. Provide surface preparation and prime paint in accordance with Section 09900, of all ferrous and galvanized surfaces.

B. Finish painting is the work of Section 09900.

END OF SECTION

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SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Finish hardware including the following:

a. Hinges and butts.

b. Lock cylinders and keying.

c. Locks, latches, and bolts.

d. Closers and door control devices.

e. Door trim units.

f. Weatherstripping.

g. Thresholds.

h. Surface bolts.

i. Astragals.

B. Related Sections

1. Section 08110 - Steel Doors and Frames

1.2 REFERENCES

A. ANSI/BHMA A156 series.

B. ADA Accessibility Guidelines for Buildings and Facilities.

C. Door and Hardware Institute - Recommended Locations for Builders' Hardware.

1.3 QUALITY ASSURANCE

A. Manufacturer - Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer (except where noted in the Schedule), although several may be indicated as offering products complying with requirements.

B. Comply with all Federal, State, and Local Codes for handicap accessibility.

1.4 SUBMITTALS

A. Product Data - Submit manufacturers' technical product data for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule - Submit final hardware schedule in manner indicated below. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand function and finish of hardware. Refer to Section 08110, Steel Doors and Frames.

1. Final Hardware Schedule Content - Based on finish hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

    a. Type, style, function, size and finish of each hardware item.

    b. Name and manufacturer of each item.

    c. Catalog cuts of each item.

    d. Fastenings and other pertinent information.

    e. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door schedule.

    f. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.

    g. Mounting locations for hardware.

    h. Door and frame sizes and materials.

C. Submittal Sequence - Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of the hardware schedule.

1. Keying Schedule - Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks have been fulfilled.

D. Samples - Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware upon request of Engineer, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.

1. Samples will be returned to the supplier. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

E. Templates - Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

1.5 PRODUCT HANDLING

A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of hardware is the responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.

D. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

E. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.6 KEY CONTROL SYSTEM

A. Provide hardware and keys compatible with Owners existing key control system.

PART 2 PRODUCTS

2.1 GENERAL

A. Coordinate all hardware with the Engineer.

B. Hand of Door - Drawings show direction of swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

C. Manufacturer's Name Plate - Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Engineer.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

D. Base Metals - Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by applicable ANSI/BHMA A156 series standard for each type hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise approved.

E. Fasteners - Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

F. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.

G. Provide concealed fasteners for hardware units that are exposed when door is closed, except to the extent that no standard units of the type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on the opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use hexscrew fasteners.

H. Tools and Maintenance Instructions for Maintenance - Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

I. Hardware Finishes

1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set for color and texture.

2. Provide finishes that match those established by BHMA.

3. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.

4. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer".

5. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, Materials & Finishes Standard, including coordination with the traditional US finishes shown by certain manufacturers for their products.

2.2 ACCEPTABLE MANUFACTURERS

A. Hinges and Butts - Hager Companies, Lawrence Hardware, Pemko Manufacturing Company, Stanley, or equal.

B. Locks - Sargent, Schlage, Yale, or equal.

C. Bolts - Ives, Rockwood, Corbin-Russwin, Sargent, Stanley, or equal.

D. Kickplates/Armorplates - Baldwin, Brookline, Cipco, Hiawatha, Liberty, Rockwood, Corbin-Russwin, or equal.

E. Overhead Closers - Corbin-Russwin, Dorma, LCN, Sargent, Yale, or equal.

F. Door Control Devices - Baldwin, Brookline, Corbin-Russwin, Door Controls Int'l., Glynn-Johnson, Ives, Rockwood, or equal.

G. Door Trim Units - Baldwin, Brookline, Rockwood, or equal.

H. Door Stripping and Seals - National Guard, Pemko, Reese, Zero, or equal.

I. Thresholds - National Guard, Pemko, Reese, Zero, or equal.

J. Exit Devices – Corbin-Russwin, Sargent, Yale, or equal.

K. Astragals - National Guard, Pemko, Reese, Zero, or equal.

2.3 HINGES AND BUTTS

A. Comply with ANSI/BHMA A156.1

B. Templates - Provide only template-produced units.

C. Screws - Furnish Phillips flat-head or machine screws for installation of units. Finish screw heads to match surface of hinges or pivots.

D. Hinge Pins - Except as otherwise indicated, provide hinge pins as follows:

1. Steel Hinges - Steel pins.

2. Exterior Doors - Non-removable pins.

3. Out-swing Corridor Doors - Non-removable pins.

4. Interior Doors - Non-rising pins.

5. Tips - Flat button and matching plug, finished to match leaves.

6. Number of Hinges - Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90-inches or less in height and one additional hinge for each 30-inches of additional height.

E. Provide Stanley Model No. FBB199 - US32D, 4½ by 4½ inch hinges, Hager Model BB1199, or equal, Non-removable pin.

2.4 LOCK CYLINDERS AND KEYING

A. General - Meet with the Engineer and Owner to finalize keying requirements and obtain final instructions in writing.

B. Metals - Construct lock cylinder parts from brass/bronze, stainless steel and nickel silver.

C. Comply with Engineer’s instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.

1. Permanently inscribe each key with number or lock that identifies cylinder manufacturer key symbol, and notation "DO NOT DUPLICATE".

D. Key Material - Provide keys of nickel silver only.

E. Key quantity - Furnish 5 change keys for each lock; 5 master keys for each master system; and 5 grandmaster keys for each grandmaster system.

1. Deliver keys to Owner.

2. Furnish 5 construction master keys.

F. Equip all locks with interchangeable cores constructed of solid brass for final and construction cores.

2.5 LOCKS, LATCHES AND BOLTS

A. Cylindrical Locks - Comply with ANSI/BHMA 156.2 Series 4000 Grade 1.

B. Mortise Locks - Comply with ANSI/BHMA A156.13 Series 1000 Grade 1 operational, Grade 3 security.

C. Strikes - Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

1. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

2. Provide roller type strikes where recommended by manufacturer of the latch and lock units.

D. Lock Throw - Provide 5/8 inch minimum throw of latch and deadbolt used on pairs of doors.

1. Provide ½ inch minimum throw on other latch and deadlock bolts.

E. Rabbeted Doors - Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.

F. Exit devices comply with ANSI/BHMA A156.3.

G. For exterior double doors, provide Sargent Model No. 8713 ETL – US32D lockset/exit device, equal by Corbin-Russwin, or equal.

2.6 CLOSERS AND DOOR CONTROL DEVICES

A. Door control devices comply with ANSI/BHMA A156.4.

B. Size of Units - Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.

1. Provide regular arms for all overhead closers, except as otherwise indicated.

2. Provide closers with reduced opening force for all handicap accessible doors.

3. Provide closers with stops where door stops are not indicated or appropriate.

C. Provide grey resilient parts for exposed bumpers.

D. Provide Yale Security Inc. Model No. PA3521, door closer, equal by Sargent, or equal. See door hardware sets for particular application. All closers should be US32D finish.

E. Provide Rockwood Model No. 440 floor stop, or equal.

F. Provide Rockwood Model No. 400 wall stop, or equal.

G. Provide Rockwood Model No. 461 kick down door stop, or equal.

H. Provide Ives Model No. 20 door silencer, or equal

I. Provide Ives Model No. 180 lockguard, equal by Hager, or equal.

2.7 DOOR TRIM UNITS

A. Fasteners - Provide manufacturer's standard exposed fasteners for door trim units (push plates, pull plates, kick plates, edge trim, and similar units); either machine screws or self-taping screws.

B. Fabricate protection plates (armor, kick or mop) not more than 1½ inch less than door width on stop side and not more than ½ inch less than door width on pull side, by 16 inches high or as otherwise indicated on the Finish Hardware Schedule.

1. Metal Plates - Stainless steel, 0.050 inch (US 18 ga.).

C. Provide Rockwood Model No. 70C, 4 inch by 16 inch SS push plate, or equal.

D. Provide Rockwood Model No. 107 x 70C SS pull plate, or equal.

2.8 WEATHERSTRIPPING

A. Provide continuous weatherstripping at each edge of every exterior door leaf. Provide non-corrosive fasteners as recommended by manufacturer for application indicated.

B. Replaceable Seal Strips - Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Weatherstripping at Jambs and Heads:

1. Provide bumper-type resilient insert and metal retainer strips, surface-applied unless shown as mortised or semi-mortise, of following metal, finish and resilient bumper material:

2. Extruded aluminum with natural anodized finish; 0.062 inch minimum thickness of main walls and flanges.

3. Extruded bronze (brass), finish to match door/frames, 0.05 inch minimum thickness of main walls and flanges.

4. Provide Pemko Model No. 305CR weatherstrip, National Guard Products Model 140PA, or equal.

D. Weatherstripping at Door Bottoms

1. Provide threshold consisting of contact type resilient insert and metal housing of design and size shown; of following metal, finish, and resilient seal strip:

a. Extruded aluminum with natural anodized finish; 0.062 inch minimum thickness of main walls and flanges.

b. Solid neoprene wiper or sweep seal complying with MIL R 6055, Class II, Grade 40.

c. Provide Pemko Model No. 315CN door bottom sweep, equal by National Guard Products, or equal.

E. Astragals

1. Provide Pemko Model No. 357C astragal, or equal.

2.9 THRESHOLDS

A. General - Except as otherwise indicated provide standard aluminum threshold unit of type, size and profile as shown or scheduled.

B. Exterior Hinged/Pivoted Doors - Provide units not less than the width of the door frame, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:

1. For out-swinging doors provide rabbeted type units with replaceable weatherstrip insert in stop.

C. Provide Pemko Model No. 172A threshold, Reese Model S426A, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations of "ADA Accessibility Guidelines for Buildings and Facilities - Federal Register/Vol. 56, No. 144, 7-26-91", and except as may be otherwise directed by the Engineer.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface projections with finishing work specified under other specifications. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to lien and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.2 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as indicated for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment - Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.3 FINISH HARDWARE SCHEDULE

A. Manufacturer's names and specific hardware models are designated in section 2 and in the hardware sets to indicate type and quality of hardware items required for each type of door indicated. However, the Contractor is not limited to the specific manufacturers listed in the specification for each hardware set.

B. Refer to the list of acceptable manufacturers listed previously for each door hardware item.

HW-1 (Exterior Double Door)

3 pr.	Hinges
1	Lockset/Exit Device
1	Threshold
2	Door Bottom Sweep
2 sets	Weatherstrip
2	Closer - No. PA3521xUS32D - Yale
2	Kick Plate
2	Flush bolts
1	Astragal
2	Kick Down Holder

END OF SECTION

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SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Surface preparation and application of coatings.

B. Related Sections

1. Section 15075- Mechanical Identification

1.2 REFERENCES

A. The Society for Protective Coatings (SSPC):

1. Surface Preparation Specifications

a. SP-1 - Solvent Cleaning

b. SP-2 - Hand Tool Cleaning

c. SP-3 - Power Tool Cleaning

d. SP-5 - White Metal Blast Cleaning

e. SP-6 - Commercial Blast Cleaning

f. SP-7 - Brush-Off Blast Cleaning

g. SP-10 - Near-White Blast Cleaning

h. SP-13 – Surface Preparation of Concrete

2. National Association of Pipe Fabricators (NAPF):

a. NAPF 500-03-01 - Solvent Cleaning

b. NAPF 500-03-02 – Hand Tool Cleaning

c. NAPF 500-03-03 – Power Tool Cleaning

d. NAPF 500-03-04 – Abrasive Blast Cleaning for Ductile Iron Pipe

e. NAPF 500-03-05 – Abrasive Blast Cleaning for Cast Ductile Iron Pipe

3. SSPC-PA 1 – Shop, Field and Maintenance Painting

4. SSPC-PA 2 - Measurement of Dry Coating Thickness with Magnetic Gages

5. SSPC Visual Standards SSPC VIS 1-89

6. SSPC Guide 4 – Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems

7. SSPC Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations

B. Occupational Safety and Health Administration (OSHA) Standards

C. American Society for Testing and Materials (ASTM)

1. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

2. ASTM F1869 – Standard Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

D. National Association of Pipe Fabricators (NAPF)

1. NAPF 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings In Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

E. International Concrete Repair Institute (ICRI)

1. ICRI 310 - Selecting And Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

1.3 SCOPE OF WORK

A. Items of work include but are not limited to the surface preparation and coating of the following:

1. Interior and exterior sides of hollow metal steel doors and frames

2. Aluminum and steel in contact with or embedded in concrete

3. Exposed electrical conduit, conduit fittings, and outlet boxes

4. Ferrous metal equipment provided by the Contractor and non-insulated ferrous metal ductwork

5. Exposed exterior piping

6. Interior piping, fittings and valves with the exception of plastic and stainless steel, unless noted otherwise

7. Fabric covered insulated pipes and ductwork

8. Piping and duct support systems

9. Touch-up painting of shop primers

10. Items listed to be painted in the interior finish schedule and on Drawings

11. Concrete, at the locations specified on the Drawings

12. Galvanized metal, at the locations specified on the Drawings

13. Back painting items that will be inaccessible to finish painting once installed including but not limited to lintels, door frames, window frames, clip angles, structural steel, miscellaneous metals

14. Concrete Masonry Units and Brick, at the locations specified on the Drawings

15. Gypsum drywall

16. Miscellaneous steel fabrications

B. Coatings are not required for glass, stainless steel, chrome, cadmium plate or aluminum that is not in contact with concrete.

C. Ventilation, dehumidification, and temperature control equipment required to provide and maintain the proper environment for worker protection and for coating application and curing.

1.4 SUBMITTALS

A. Applicator qualifications for general coatings.

B. Applicator qualifications for H_2S resistant coatings

C. List of coating products and systems proposed, giving brand, type and manufacturer.

D. Product for product listing of the manufacturer's coating system showing a comparison with the specified coating systems in Schedules 09900-A and 09900-B.

E. Manufacturer's current printed recommendations and product data sheets for each system, and ASTM performance criteria.

F. Paint manufacturer's compatibility guide, to be a complete listing of all compatible paint systems/combinations produced by the paint manufacturer.

G. Copies of manufacturer's complete color charts for each coating system.

H. When requested by the Engineer, provide product container labels and labeled mixing instructions for products utilized in the Work.

I. Method and equipment to be used for dehumidification.

J. Ventilating plan describing procedures and equipment that will be used.

K. Method and equipment to be used for temperature control.

1.5 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods required for proper performance of the work in this Section.

B. Applicator Qualifications – Minimum 5 years experience in application of specified products.

C. Regulatory Requirements – Meet federal, state and local requirements limiting the emission of volatile organic compounds.

D. A qualified and experienced representative of the paint manufacturer shall meet with Contractor and Engineer to coordinate items requiring painting and to schedule the Work. Monthly field visits shall occur to ensure proper application of the painting system. The Contractor shall coordinate with the paint manufacturer to schedule site visits.

E. Use equipment of adequate size, capacity, and quantity to accomplish the work of this Section in a timely manner.

1.6 DELIVERY, HANDLING, STORAGE AND PROTECTION

A. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.

B. Storage of materials shall be in accordance with the paint manufacturer's recommendations.

C. Store coated items carefully. Store paints and painter's materials only in areas designated solely for this purpose. Avoid damaging or dirtying coatings by contact with soil, pavement or other harmful materials that might necessitate special cleaning. Use suitable blocking during storage.

D. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.

E. Do not expose primed surfaces to weather for more than six months before top coating. Allow less time if recommended by coating manufacturer.

F. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.

G. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours. Finally, dispose of waste in an approved disposal system.

H. During surface preparation, cleaning and painting operations, protect all surfaces not to be painted.

I. Protect coated items, whether prime or finish, from damage due to shipping and handling. Use padding, blocking, fabric slings and extra care as required.

J. Upon completion of field painting, ensure coatings are undamaged and in good condition. Repair damaged or deteriorated coating, resulting from failure to observe foregoing requirements.

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply coatings when dust is being generated.

B. Cover or otherwise protect work by other trades and surfaces not being painted during all painting operations.

C. All shop primed ferrous metals shall be primed using the same coatings specified in the paint schedule.

1.8 EXTRA MATERIALS

A. Provide one spare 1 gallon paint container for each type and color applied.

B. Multi-component products shall have sufficient unopened quantities of each component to produce the required amount of mixed paint for future maintenance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Coating systems are designated by reference to Tnemec Company, Inc. and Sherman Williams products to establish the type and quality required. The Engineer reserves the right to request and receive detailed technical literature of each proposed coating system before approval.

B. No coating systems will be considered that decrease the film thickness, decrease the number of coats, decrease the effectiveness of the surface preparation or change the type of coating specified in the schedule of this section.

2.2 MATERIALS, GENERAL

A. Paint Coatings - Suitable for intended use, recommended by their manufacturer for intended service. All coatings, unless otherwise specified, shall be suitable for severe service.

B. Products Used - Minimum of five years satisfactory use under similar service conditions.

C. Use products of one manufacturer in any one paint coating system; all coating materials compatible. Coatings for touch-up - same as original.

D. Equipment prime or finish painted by the equipment manufacturer shall be painted in strict accordance with this Section and the equipment's individual specification section.

E. Bear entire responsibility in providing complete compatibility of all shop and field painting systems.

F. It is recognized that the specific application of the coating products varies for each specific manufacturer (number of coats, mil thickness per coat, etc.). Therefore, these Specifications represent the minimum to be provided under this contract and shall be increased in accordance with each manufacturer’s recommendations.

2.3 COLORS AND FINISHES

A. All finish colors will be selected from manufacturer's color chips. The Owner will select the colors. Match final colors to selected color chips, as scheduled.

B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.

C. Unless otherwise indicated, use gloss or semi-gloss for finish paint.

2.4 COATING TYPES

A. Coating types and minimum acceptable percent (by volume) of component solids are described in Schedule 09900-A Coating Types. Description of coating systems including surface preparation and dry film thicknesses are included in Schedule 09900-B Coating Systems.

PART 3 EXECUTION

3.1 GENERAL

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work.

B. Do not proceed with surface preparation or coating application until conditions are suitable.

C. The following shop and field instruments shall be used to inspect surface preparation and dry film thickness.

1. SSPC visual standards SSPC-VIS 1-89
2. Testex Press-O-Film replica type x-coarse
3. Surface temperature thermometer
4. Sling psychrometer and psychrometric tables
5. Type I or Type II dry film thickness gauges
6. SSPC-PA2 methods

3.2 PREPARATION

A. Basic Steps

1. Arrange to do all preparation and paint work in heated enclosure unless ambient weather conditions ensure still, dry air and a minimum of 50 degree F temperature. Do not apply paints to surfaces in direct sunlight.
2. Coordinate cleaning and painting operations to eliminate contamination of one by the other.
3. Maintain all coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean, proper containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.
4. Ensure proper coordination of materials to be applied hereunder with previous coatings on affected surfaces. Have all manufacturer's written directions on hand, and follow them strictly, except where otherwise specified.
5. Carefully coordinate preparation and material compatibility requirements of paint systems used by manufacturers to shop prime equipment.

B. Before any paint application, carefully clean all surfaces to be coated of dust, dirt, grease, rust, mill scale, paint unsuitable for top coatings, efflorescence, oil, moisture, foreign matter or conditions detrimental to coating bond and durability.

1. Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.
2. Fill imperfections and holes in surfaces to be painted.

C. Metals

1. Prepare all field and shop primed ferrous metals, including galvanized ferrous metals, in accordance with Schedule 09900-B Coating System Schedule included under this Section.

2. A needle gun may be used for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface.

3. Bituminous coated metals for paint finish - clean of all dirt, grease, oil and foreign matter, and prime with a barrier coat to seal the bitumen and prevent bleeding and discoloration of finish.

4. Prepare non-ferrous and galvanized metal surfaces for finishing in accordance with SSPC-SP16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steels, Stainless Steels and Non-Ferrous Metals. Provide minimum uniform anchor profile of 1 mil. Apply coatings as outlined on the Paint Schedule.

D. Provide higher degree of cleaning for acceptable equivalent paint products when paint manufacturer recommends in his printed surface preparation recommendations.

E. Concrete for Paint Finishes

1. Clean thoroughly of all form oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove laitance; roughen smooth surfaces by brush sand blasting in accordance with SSPC-SP13 Surface Preparation of Concrete (Reference ICRI CSP 3-5 visual standards).

2. After concrete has dried, prime where required in strict accordance with manufacturer's printed instructions.

3. Concrete Floors - Prepare all surfaces in accordance with SSPC-SP13 Surface Preparation of Concrete utilizing Shot-Blasting or Mechanical surface preparation. Reference (ICRI CSP- 3-5 visual standards). Acid washing is not permitted.

4. Concrete for submerged service: Prepare all surfaces via abrasive blast cleaning in accordance with SSPC-SP13 Surface Preparation of Concrete. Reference (ICRI CSP- 3-5 visual standards). Acid washing is not permitted.

F. Concrete masonry units for paint finishes:

1. Clean thoroughly by brushing, scraping and sanding or grinding slick areas.

2. Solvent wash oil, grease, and paint spots before applying block filler.

G. Before applying field coat, touch-up abraded areas of shop coats with paint of the same type. Apply an entire coat if necessary. Touch-up coats are in addition to, and not a substitute for first field coat. Clean deteriorated surfaces to bare metal before applying touch-up coat.

H. After installation and before applying field coats, touch-up all scratches and blemishes on equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer.

I. After installation, touch up all scratches and blemishes on all steel.

3.3 VENTILATION

A. Particular care shall be exercised during the cleaning and painting of each room. Means of adequately removing air from each room shall be provided, in order to remove dust and solvent vapors.

B. During the cleaning and painting operations, the painters shall be provided with proper respiratory protection in accordance with OSHA regulations.

C. In addition to meeting the minimum requirements listed above, the Contractor shall be responsible for complying with all applicable regulations of the various local, state, and federal agencies.

3.4 DEHUMIDIFICATION

A. Continuous dehumidification of areas where paint coatings will be applied may be required twenty-four hours per day during all surface preparation, painting, and curing. The equipment used must be capable of maintaining the interior air quality at or below 20 percent relative humidity during surface preparation and between 40% and 80% during the coating application and curing process of interior finish coat(s). The surfaces must be dry and 5 degrees above the dew point.

B. Humidity shall be monitored using a strip chart recorder that provides continuous measurement of humidity and air temperature.

C. In the event of dehumidification equipment failure, prepared surfaces that have been approved for priming will not be allowed to stand uncoated and must be painted before the end of the shift.

3.5 TEMPERATURE CONTROL

A. Auxiliary heat and/or cooling may be necessary to maintain the room temperature at an acceptable level for the coating manufacturer's application parameters. The equipment must be compatible with the required dehumidification equipment and meet the following requirements.

1. The air from heaters and refrigerant type systems shall be connected to the process air supply duct from the dehumidifier.

2. Only electric, indirect fired combustion, or steam coil auxiliary heaters may be used. Direct-fired space heaters are not permitted during the blasting, coating or curing phases.

3. Heaters shall be equipped with controls that automatically turn the heaters off if the airflow is interrupted or the internal temperature exceeds its design temperature or that of the supply duct.

4. The area where dehumidification is introduced shall be sealed to allow the air to escape away from the entry point while maintaining a slight positive pressure unless dust from the operation is hazardous. The design of the filter system, if necessary, shall be such that it does not interfere with the dehumidification equipment's ability to control the dew point and temperature parameters in that space. Do not recirculate the air from the space or from the filtration equipment back through the dehumidifier during the coating application or when solvent vapors are present.

5. Maintain a minimum temperature of 50 degrees F for a minimum of seven (7) days after a coating application.

3.6 APPLICATION

A. Conditions

1. Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing within the paint coatings curing time as specified by the paint manufacturer. Avoid painting of surfaces while they are exposed to direct sunlight.

2. Paint surfaces which have been cleaned, pretreated, or otherwise prepared for painting with first finish coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.

3. Coat blast cleaned metal surfaces immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.

4. Work shall conform to SSPC-PA 1.

B. Methods

1. Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations, except where specifically directed otherwise. Control temperature of materials upon mixing and application, surface temperature and condition, thinning and modifying.

2. Protect surfaces to be coated, before, during and after application unless ambient weather conditions are favorable.

C. Workmanship

1. Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.

   a. Control thinning for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.

   b. Record quantities of materials of each type, for each coat used.

2. Apply paints and coatings using skilled painters, brushed or rolled or sprayed out carefully to a smooth, even coating without runs or sags. Allow each coat of paint to dry thoroughly, on the surface and throughout the film thickness, before the next coat is applied. High polymer coatings may be exempted from the drying requirement if recoat time is specified by manufacturer.

3. Finish surfaces - Uniform in finish and color, and free from flash spots and brush marks.

4. Accessory items, finish hardware, lighting fixtures, escutcheons, plates, trim and similar finish items not to be painted: Remove or carefully mask before painting

adjacent surfaces; carefully replace and reposition upon completion of adjacent painting and cleaning work.

3.7 PROTECTION, CLEAN-UP

A. Protect all materials and surfaces painted or coated under this Section, from the time of surface preparation until the final coat has fully dried. Also protect all adjacent work and materials from touch-up painting by the use of sufficient drop cloths during the progress of this work. Upon completion of the work, clean up all paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

3.8 PAINT SCHEDULE

A. Coordinate, schedule and confirm the various cleaning, touch-up and finishing operations. Ensure the transmission of materials data, color selections and coating system methods between the coating applicators. Take responsibility for not exceeding exposure and recoat time limits.

B. Color code all piping in accordance with Schedule 09900-C, Color Schedule.

3.9 FACTORY ASSEMBLED EQUIPMENT AND SKID PACKAGES

A. Painting fabricated ferrous assemblies, frames, supports, skids, vessels, tanks, and OSHA guards shall strictly conform to the requirements of this Section including SSPC-SP6 surface preparation, epoxy primer, and intermediate coats, and a polyurethane topcoat.

B. Painting of piping shall be in accordance with this section.

C. The Engineer shall be given a minimum 7 day notice to witness blasting and painting operations.

D. Painting of electrical components, motors and enclosures shall be manufacturer's standard coating system with a minimum of an industrial grade painting system.

E. Submit detailed schedule of painting system(s) to be used for all equipment to the Engineer. All schedules shall be provided prior to commencement of all painting operations.

F. Stainless steel and aluminum are not required to be painted unless it is the manufacturer's standard practice.

3.10 FIELD QUALITY CONTROL

A. Unsatisfactory Application

1. If surface has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.

2. Evidence of runs, bridges, shiners, laps or other imperfections is cause for rejection.

3. Repair defects in accordance with written recommendations of coating manufacturer.

B. Damaged coatings, Pinholes and Holidays

1. Feather edges and repair in accordance with recommendations of paint manufacturer.

2. Hand or power sand visible areas of chipped, peeled or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on the extent of repair and appearance, a finish sanding and topcoat may be required.

3. Apply finish coats, including touchup and damage repair coats in a manner that will present a uniform texture and color-matched appearance.

3.11 FINAL TOUCH-UP

A. Prior to final completion and acceptance, examine painted and finished surfaces and retouch or refinish as necessary to leave surfaces in perfect condition.

Schedule 09900-A - Coating Types		
Tnemec Company Inc.	Sherwin-Williams	Type of Coating System (Solids Content by Volume)
Series 1026 Enduratone	DTM Acrylic Primer-Finish or Pro Industrial Pro-Cryl Universal Acrylic Primer	Acrylic Emulsion (43.0 ± 2.0%).
Series 20HS Pota-Pox	Macropoxy 646 PW Potable Water Epoxy or Macropoxy 5500 Low VOC Epoxy	Polyamide Epoxy (77.0 ± 2.0%)
Series FC20HS Pota-Pox (Fast Cure)	Macropoxy 646 PW Potable Water Epoxy or Macropoxy 5500 Low VOC Epoxy	Polyamide Epoxy (77.0 ± 2.0%)
Series 1029 Enduratone	Sher-Cryl HPA High Performance Acrylic-Semi-Gloss	HDP Acrylic Polymer (40.0 ± 2.0%)
Series 66HS Hi-Build Epoxoline	Macropoxy 5500 Low VOC Epoxy	Polyamide Epoxy (78.0 ± 2.0%)
Series 73 Endura Shield	Acrolon 218 HS Acrylic Polyurethane-Semi-Gloss	Aliphatic Acrylic Polyurethane (58.0 ± 2.0%)
Series 94-H2O Hydro-Zinc	Corothane I Galvapac 2K 100 Zinc Primer (NSF)	Aromatic Urethane, Zinc Rich (63.0 ± 2.0%)
Series 151 Elasto-Grip	Preprite ProBlock Interior/Exterior Latex Primer	Waterborne Modified Polyamine Epoxy (17.0 ± 2.0%)
Series 218 MortarClad	Dura-Plate 2300 WB Epoxy Cementitious Resurfacer	Epoxy Modified Concrete (100%)
Series 217 MortarCrete	AW Cook Cement Cemtec MSM Mortar or Rapid Cure Vertical Grade.	Acrylic Modified Cement (100%)
Series 434 PermaShield	DuraPlate 5900 HB Epoxy (formerly Cor-Cote SC Plus) with Type SC aggregate.	Modified Aliphatic Amine Epoxy Mortar (100%)
Series 435 Perma-Glaze	Dura-Plate 5900 HB Epoxy (formely Cor Cote SC Plus).	Modified Polyamine Epoxy (100%)
Series 1 Omnithane	Corothane I Galvapac Two Pack Zinc Primer (NSF).	MIO/Zinc-Filled Urethane (61.0 ± 2.0%)

Schedule 09900-B - Coating Systems				
Surface	System Surface Preparation (Shop/Field)	System Finishes		
		Primer	2nd	Final
		DFT = Dry Film Thickness, Mils		
Ferrous Metals, Interior Non-Submerged	SSPC-SP-6	Series 1 (2.5-3.5 DFT)	Series 66HS (4.0-6.0 DFT)	Series 73 (2.5-5.0 DFT)
		Corothane I Galvapac 2K	*Macropoxy 646 FC Epoxy*	*Acrolon 218 HS Polyurethane*
Ferrous Metals, Exterior Non-Submerged	SSPC-SP-6	Series 1 (2.5-3.5 DFT)	Series 66HS (3.0-5.0 DFT)	Series 73 (2.5-5.0 DFT)
		Corothane I Galvapac 2K	*Macropoxy 646 FC Epoxy*	*Acrolon 218 HS Polyurethane .*
Interior Concrete Walls & Ceilings	SSPC-SP13 (ICRI CSP 3); Fill all voids and bugholes with Series 215 Filler Surfacer	Series 66HS (3.0-5.0 DFT)		Series 66HS (4.0-6.0 DFT)
		Macropoxy 646 FC Epoxy		*Macropoxy 646 FC Epoxy*
Ferrous Metals, Submerged or Intermittently Submerged – Non-Potable Open Space	SSPC-SP-10	Series 1 (2.5-3.5 DFT)	Series 66HS (6.0-8.0 DFT)	Series 66HS (6.0-8.0 DFT)
		Corothane I Galvapac 2K	*Macropoxy 5500 or 646 PW.*	*Macropoxy 5500 or 646 PW.*
Submerged or Intermittently Submerged Concrete – Non-Potable, Enclosed and Partially Enclosed Spaces - Head Space and Top Wall Sections, H_2S Resistant up to 100 ppm, pH<4	SSPC-SP-13 (Reference ICRI CSP 5)	Series 218 (~125 mils DFT)		Series 434 (125 DFT)
		Dura-Plate 2300	*Dura-Plate 5900*	*Dura-Plate 5900 + Type SC aggregate*
Ferrous Metals, Submerged or Intermittently Submerged – Non-Potable – Enclosed/Partially Enclosed Spaces, H_2S Resistant	SSPC-SP-5 Min Anchor Pattern 3.0 mils	Series 435 (15-20 DFT)		Series 435 (15-20 DFT)
		Dura-Plate 5900		*Dura-Plate 5900*

Schedule 09900-B - Coating Systems				
Surface	System Surface Preparation (Shop/Field)	System Finishes		
		Primer	2nd	Final
		DFT = Dry Film Thickness, Mils		
Ductile and Cast Iron Pipe, Interior and Exterior, Non-submerged	NAPF 500-03-04 / SSPC-SP-6	Series 66HS (3.0-5.0 DFT)	Series 66HS (3.0-5.0 DFT)	Series 73 (2.5-5.0 DFT)
		Macropoxy 646 FC Epoxy	*Macropoxy 646 FC Epoxy*	*Acrolon 218 HS Polyurethane*
Ductile and Cast Iron Pipe, Interior and Exterior, Submerged. Non-potable	NAPF 500-03-04 / SSPC-SP-10	Series 66HS (3.0-5.0 DFT)	Series 66HS (3.0-5.0 DFT)	Series 66HS (4.0-6.0 DFT)
		Macropoxy 5500 or 646 PW	*Macropoxy 5500 or 646 PW*	*Macropoxy 5500 or 646 PW*
Non-Ferrous Metal (Other Than Galvanized), Submerged or Intermittently Submerged	SSPC-SP-16 Surface Preparation of Galvanized Steel (Minimum 2 mil anchor profile)	Series 66HS (3.0-5.0 DFT)		Series 66HS (4.0-6.0 DFT)
		Macropoxy 646 PW		*Macropoxy 646 PW*
Wood, Exterior or Interior	Sand Smooth & Remove Dust	Series 151-1051 (1.0-1.5 DFT)	Series 1029 (2.5-3.5 DFT)	Series 1029 (2.5-3.0 DFT)
		Preprite ProBlock Int/Ext Primer	*Sher-Cryl HPA Semi-gloss*	*Sher-Cry HPA Semi-Gloss*
Gypsum Drywall	Sand Smooth and Remove Dust	Series 151 (1.0-1.5 DFT)	Series 1029 (2.0-3.0 DFT)	Series 1029 (2.0-3.0 DFT)
		Preprite ProBlock Int/Ext Primer	*Sher-Cryl HPA*	*Sher-Cryl HPA*

Notes

(1) Tnemec Products are listed in the first row for each surface and Sherwin-Williams products are listed in italics on the second row for each surface without a dry film thickness. Refer to Paragraph 2.1 for "or equal" products.

Schedule 09900-C - Colors	
Item	**Color**
Sludge Pipes/ Raw Sewerage	Light Brown
Plumbing Drains and Vents	Black
Bollards	Safety Yellow
Notes: (1) For piping not to be painted (see Paragraph 1.4 B), the color coding shall apply to the background color of the identification markers provided in Section 15075.	

END OF SECTION

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SECTION 10440

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Section includes the following:

a. Safety Signs

b. Exterior Building Signs

c. Exit Signs

d. Ancillary Materials

1.2 REFERENCES

A. OSHA General Industry Standard paragraph 1910.145 (29 CFR 1910).

B. ADA Accessibility Guidelines for Buildings and Facilities – Federal Register, Vol. 56, No. 144, 7-26-91.

C. American National Standards Institute (ANSI) A117.1 – American Standard for Building and Facilities Providing Accessibility and Usability for Physically Handicapped People.

D. National Fire Protection Association (NFPA) 49 – Hazardous Chemical Data.

E. National Fire Protection Association (NFPA) 704 – Standard System for the Identification of the Hazards of Materials for Emergency Response.

F. U.S. Department of Transportation, Federal Highway Administration – Manual on Uniform Traffic Control Devices for Streets and Highways.

G. ASTM International A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

H. ASTM International D709 – Standard Specification for Laminated Thermosetting Materials.

1.3 SUBMITTALS

A. Submit to the Engineer in accordance with Section 01330, shop drawings showing dimensions, layout and details of construction and accessories required.

B. Submittal shall include a detailed list of the type and quantity of each sign to be supplied.

C. Submit to the Engineer a sample of each sign to be provided.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide signage as detailed on the “Signage Schedule” or otherwise specified herein.

2.2 MANUFACTURER

A. Manufacturers – subject to compliance with specification requirements, provide products of one of the following:

1. Seton Identification Products
2. ASI Sign Systems
3. Best Sign Systems
4. or equal

2.3 SAFETY SIGNS – LAMINATED PLASTIC LABELS

A. Provide signs suitable for outdoor use: polyester labels laminated for durability.

B. Signs shall be UV-resistant, with weatherproof overlaminate to protect the label from moisture, solvents, chemicals, abrasion and fading, and able to easily wipe off dirt, dust, or grease.

C. 4 mil thick plastic with aggressive adhesive.

D. Glossy finish, easy to clean and mar-resistant.

E. Labels shall be able to withstand chemical splashes and suitable to be used indoors or outdoors.

F. Provide signs in accordance with the Signage Schedule in Section 3.2.

2.4 EXTERIOR BUILDING SIGN

A. Exterior building identification sign shall consist of 12-inch high aluminum letter in architectural font with baked enamel finish (color to be selected by Owner from manufacturer's full range of colors).

B. Location, spacing, and lettering shall be as directed by Owner.

2.5 EXIT SIGNS

A. Material: Plastic, 1/8 inch minimum thickness.

B. Letters: 6 inches high, with ¾-inch stroke; 2 inches wide, except for letter "I", with spacing of 3/8 inch.

C. Colors: Red letters on white background.

2.6 ANCILLARY MATERIALS

A. Fasteners: Stainless steel screws or bolts of appropriate sizes.

B. Manufacturer's standard brackets for wall mounting of two-sided exit signs.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install safety signs, legends and markings at locations either shown on the Drawings, listed in the Signage Schedule, or as directed by the Engineer.

B. Attach labels according to the Manufacturer's instructions and in accordance with the materials the signs will be attached to.

3.2 SIGNAGE SCHEDULE

A. Safety Signs

Sign	Color	Size	Quantity
"Danger Confined Space – Wear a Gas Meter, Follow Confined Space Entry Procedures" – on wet well access hatch and valve vault access hatch	Red, white, and black	10" x 7"	2
"Danger Electrical Equipment Authorized Personnel Only" – on electrical enclosures	Red, white, and black	10" x 7"	2
"Caution Standby Generator Automatically Starts During Power Outage" – on generator	Yellow and black	10" x 7"	1

3.3 CLEAN-UP

A. Clean signs of all dirt, grease, paint, stains, etc. after installation.

B. Replace all signs that are damaged or permanently marred during construction.

END OF SECTION

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SECTION 10522

FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Fire extinguishers
2. Mounting brackets

B. Related Sections

1. Section 10440 – Interior Signage

1.2 REFERENCES

A. Factory Mutual Research Corporation

B. NFPA 10 Portable Fire Extinguishers - National Fire Protection Association

C. ADA Accessibility Guidelines for Buildings and Facilities

1.3 DEFINITIONS

A. "Fire Extinguishers" as used in this Section refer to units that can be hand-carried as opposed to those which are equipped with wheels or to fixed fire extinguishing systems.

1.4 SUBMITTALS

A. Product Data: Submit product data for each type of product included in this Section.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility - Obtain products in this Section from one manufacturer.

B. UL-Listed Products - Provide new portable fire extinguishers, which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

C. FM Listed Products - Provide new portable fire extinguishers, which are approved by Factory Mutual Research Corporation for type, rating and classification of extinguisher indicated and carry appropriate FM marking.

D. Provide fire extinguishers which meet NFPA 10.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer - Subject to compliance with requirements, provide fire extinguishers from one of the following:

1. Amerex
2. Badger Fire Protection
3. Sentry
4. or equal

2.2 MATERIALS

A. Fire Extinguishers

1. General - Provide fire extinguishers for each location indicated, in colors and finishes selected by the OWNER's Project Representative from manufacturer's standard which comply with requirements of governing authorities.

2. Provide multi-purpose mono-ammonium phosphate dry chemical extinguishers used for Class A, B, and C fires.

3. Extinguisher shall be heavy-duty steel cylinders with polyester/epoxy finish.

B. Mounting Brackets

1. Provide manufacturer's standard bracket designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install items included in this Section in locations and at heights to comply with applicable regulations of governing authorities, including, but not limited to, the State Building Code and the more stringent of the State and Federal Handicap Accessibility Guidelines listed in Section 1.2.

B. Securely fasten mounting brackets to structure, square and plumb, to comply with manufacturer's instructions.

C. Where exact location of fire extinguisher is not indicated, locate as directed by OWNER's Project Representative.

3.2 IDENTIFICATION

A. Identify extinguishers with signs as described in Section 10440. Mount sign on bracket off the wall.

3.3 SCHEDULE

Location	Size	Quantity	Wall Mounting Bracket	Cabinet
Precast Electrical Structure	10 lb.	1	Yes	No

END OF SECTION

J:\V\V0037 Vernon WWTP\017 - Exit 67 Sewer Extension Design\Design\Specifications\Div 10\10522 Fire Extinguishers and Accessories.docx

SECTION 11000

EQUIPMENT - GENERAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. General requirements for the equipment and services to be provided under the Sections of Divisions 11, 13, and 15, including, but not limited to, the following:
   a. Structural design (including seismic, wind, snow, and buoyancy)
   b. Electrical requirements for vendor supplied equipment and control panels
   c. Handling, storing, and installing materials and equipment during the progress of the work
   d. Coordination with equipment suppliers and subcontractors
   e. Anchor bolts, assembly hardware, and foundations
   f. Services of manufacturers' representatives for start-up, inspection, and testing
   g. Operation and maintenance manuals
   h. Operator training
   i. Lubricants, spare parts, nameplates, special tools, and safety equipment
   j. Surface preparation and shop prime painting of equipment
   k. Off-site inspection
   l. Equipment substitutions

B. Related Sections

1. Section 01770, Closeout Procedures
2. Section 03300, Cast-in-Place Concrete
3. Section 09900, Painting
4. Section 11312, Submersible Wastewater Pumping Equipment
5. Division 11 – Equipment
6. Division 13 – Special Construction
7. Division 15 – Mechanical
8. Division 16 – Electrical

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE AND HANDLING

A. Provide dry, heated, and ventilated storage facilities for materials and equipment awaiting incorporation in the Work. Be responsible for the protection, loss of, or damage to materials and equipment furnished until final completion and acceptance of the work. Pay for all storage and demurrage charges from suppliers and transportation companies. Defective material and equipment shall be removed immediately from the site of the work, at no additional cost to the Owner.

B. Coat all machined surfaces subject to corrosion with an easily removable rust preventive compound prior to shipment.

C. Ship fabricated assemblies in the largest sections permitted by carrier regulations, properly labeled for field erection.

D. Deliver equipment in manufacturer's original, unopened, and undamaged packages, unless mounted on equipment assembly.

E. Contractor shall store and maintain all equipment in strict accordance with the manufacturer's written short-term and long-term storage requirements.

F. Store in a manner to protect items with epoxy shop coatings from exposure to UV light which can cause chalking of the epoxy. Length of acceptable exposure prior to providing UV protective measures shall be in accordance with coating manufacturer's recommendations. This includes protection from UV light after installation while awaiting covering or filling of tanks, or field finish painting for items scheduled to be top coated.

G. Should damage occur, immediately make all repairs and replacements necessary to the satisfaction of the Engineer at no cost to the Owner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Anchor bolts, nuts, washers, bolt sleeves, and assembly hardware shall be Type 316 stainless steel. Expansion bolts shall be "Thunderstuds", as manufactured by Unifast Industries, Inc., Hauppauge, NY; Redhead "Wedge Anchors" as manufactured by ITT Phillips, Michigan City, ID; Parabolt as manufactured by the Molly Division Emhart Corp., or equal. Epoxy encapsulated bolts shall be Hilti HIT-HY 200 Adhesive Anchors or equal. All expansion bolts and associated hardware are to be stainless steel.

B. Grout shall meet the requirements of Section 03300.

C. Programmable Logic Controllers shall meet the requirements of Section 11312, Submersible Wastewater Pumping Equipment.

D. Manufacturer provided electrical work shall meet the requirements of Division 16 - Electrical. All electrical equipment shall have a short circuit current rating (SCCR) and/or available interrupting current (AIC) rating of at least 65,000 amps for 480V equipment and at least 10,000 amps for lower voltage equipment, unless otherwise specified in Section 16050.

E. Field electrical work is included in Division 16.

F. Surface preparation and shop prime painting shall meet the requirements of Section 09900.

G. Nameplates - Provide with each piece of equipment a nameplate of non-corrodible metal, fastened in place, and permanently inscribed with the manufacturer's name, model or type designation. Provide motor nameplates separately as required per Division 16.

H. Equipment Drive Guards - Provide approved all-metal guards to enclose the drive mechanism for equipment driven by open shafts, belts, chains, or gears. Guards are to be constructed of galvanized sheet steel or galvanized one inch mesh screen (woven wire or expanded metal) set in a frame of galvanized steel members. Secure guards in position by steel braces or straps, which will permit easy removal for servicing the equipment. Equipment guards shall conform with all applicable OSHA requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation and Shop Prime Painting

1. Paint System: Upon receipt of approval by the Engineer, notify all equipment and material suppliers of the selected manufacturer of the paint for the project. Give written direction to each supplier with prime paint designations, colors, and mil thickness coverage requirements. Primer paint must be compatible with the specified and approved field-applied topcoats. Surface preparation and shop priming shall be in accordance with the provisions of Section 09900 unless otherwise specified in Division 11 Sections. Ship chains, sprockets, gears, and the like from the factory with a heavy coating of protective grease.
2. Field painting shall be in accordance with the provisions of Section 09900.
3. Certain equipment is specified to be field prepared and field primed. Refer to appropriate equipment sections for definition.

3.2 ERECTION, INSTALLATION, APPLICATION

A. Coordination

1. Coordinate mechanical, electrical and instrumentation requirements of the equipment covered by this section with each of the Suppliers and Subcontractors working on the project. This includes but is not limited to providing each with copies of preliminary and final submittals for each equipment item that may impact the work of another Supplier or Subcontractor. The Owner is not liable for any additional costs that originate from the Contractor's failure to properly coordinate this work. The Owner is not responsible for any extra costs related to removal or replacement of equipment, components, conduits, or wire resulting from the failure to coordinate equipment requirements.

B. Anchor Bolts, Inserts and Assembly Hardware

1. Anchor bolts and expansion bolts are to be provided by the manufacturer and set accurately in the Work by the Contractor. Anchor bolts that are set before the concrete has been placed shall be carefully held in templates. Where specified in the Contract Documents, anchor bolts shall be provided with square plates at least 4 inches by 4 inches by 3/8 inches. Alternatively, provide anchor bolts that have square heads and washers and set in the concrete forms with pipe sleeves. If expansion bolts are set after the concrete has been placed, drill and grout or caulk. Do not damage the structure or finish by cracking, chipping, or spalling concrete during the drilling and setting. Engineer will approve the setting of expansion bolts after placement of concrete.
2. Concrete inserts shall be designed by the manufacturer to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used by the inserts. Provide galvanized inserts which permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut.
3. Manufacturer shall provide assembly hardware in accordance with the complete parts list. Label all assembly hardware and package separately for delivery to the job site.

C. Foundations, Installation, and Grouting

1. Furnish the necessary materials and construct concrete foundations for all equipment installed. Foundation size and elevations may be determined in the

field by the Engineer. The tops of foundations shall be at such elevations as will permit grouting as specified below.

2. Install all equipment in accordance with the manufacturer's instructions.

3. In setting pumps, motors, and other items of equipment, make an allowance of at least 1 inch for grout under the equipment bases. Use steel shims to level and adjust the bases. If shims are left embedded in the grout, install neatly and so as to be as inconspicuous as possible in the completed Work. Unless otherwise required by the manufacturer, use a non-metallic non-shrink grout as specified in Section 03300.

4. Mix and place grout in accordance with the manufacturer's recommendations. Where practicable, place the grout through the grout holes in the base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form. Construct form to provide a 1-inch chamfer around the top edge of the finished foundation. Where such procedure is impracticable, the method of placing grout shall be as permitted by the Engineer. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if necessary.

5. Rub foundations and exposed grout surfaces in accordance with 03300.

6. If threaded rod with lower support nuts is used to secure the equipment in place temporarily during concrete equipment pad placement, the support nuts shall be removed prior to grouting so that the threaded rod anchor bolts are not supporting the equipment and the top nuts can be tightened to secure the equipment directly to the large bedding surface provided by the non-shrink grout and concrete equipment pad. Equipment foundations shall be designed to absorb equipment vibration and transmit forces to building structure or ground.

3.3 SITE QUALITY CONTROL

A. Performance Tests – General

1. All equipment, components and systems furnished under this Contract, including those furnished by Subcontractors, must be demonstrated to achieve compliance with the Contract performance requirements.

2. Furnish all chemicals, fuel, water, media required for the start-up, debugging, and performance testing of all systems furnished under this Contract.

B. Services of a manufacturer's representative

1. Arrange for a qualified service representative from each company manufacturing or supplying equipment to perform the work described in this section.

2. Inspect, operate, test, and adjust the equipment after installation has been completed and the equipment is presumably ready for operation, but before it is operated by others. At a minimum, include the following points in the inspection:

   a. Soundness (without cracked or otherwise damaged parts).

   b. Completeness in all details, as specified.

   c. Correctness of setting, alignment, and relative arrangement of various parts.

   d. Adequacy and correctness of packing, sealing and lubricants, etc.

3. Operate, test, and adjust equipment to prove that it is left in proper condition for satisfactory operation under the conditions specified.

4. Upon completion of this work, submit, 3 copies to the Engineer of a complete, signed report of the results of this inspection, operation, adjustments, and tests. Include in report a detailed description of the points inspected, tests and adjustments made, quantitative results obtained, and suggestions for precautions to be taken to ensure proper maintenance. Certify in the report that the equipment (1) has been satisfactorily installed and conforms to the Contract Documents; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping, supports or anchor bolts; (4) has been operated under full load and operates satisfactorily; and (5) that nothing in the installation will render the manufacturer's warranty null and void.
5. After the Engineer has reviewed the reports from the manufacturer's representatives, make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.

C. Off-Site Inspection - Fabrication, manufacture, painting or testing work may be inspected by the Engineer before shipment. Give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection can be made.

3.4 CLOSEOUT ACTIVITIES

A. Operator Training

1. Upon satisfactory completion of the start-up and calibration, provide the services of a manufacturer’s trained representative to instruct Owner's personnel in the proper operation and maintenance of the equipment. This separate period of on-site training shall be provided independent of start-up and testing services.
2. The manufacturer's trained representative who will be providing the instruction shall have prior operation, maintenance and instructing experience acceptable to the Engineer.
3. When requested, submit the manufacturer's trained representative's name and qualifications to the Engineer for approval at least one week prior to the scheduled operating and maintenance instruction sessions.
4. Provide the Owner with a minimum 7 days written notice of planned operator training.
5. Coordinate the scheduling of on-site training to meet the following requirements:
    a. No single training session shall be more than 6 hours duration or 4 hours if specified to occur on 2 or more separate days.
    b. Training shall not be scheduled on two consecutive days.
    c. No more than 3 training sessions shall be scheduled in any week.
    d. Training sessions shall not be scheduled for Saturdays, Sundays or holidays.
    e. Owner may elect to video these trainings for their own use of training new employees.

3.5 PROTECTION

A. Protection Against Electrolysis - Where dissimilar metals are used in conjunction with each other, provide insulation between adjoining surfaces to eliminate direct contact and any resultant electrolysis. Use bituminous impregnated felt, heavy bituminous coating, non-metallic separators or washers, or other approved materials as insulation materials.

3.6 MAINTENANCE

A. Lubricants - Prior to testing and acceptance, furnish a one year's supply of all lubricants recommended by the manufacturers of each component of the equipment provided.

B. Spare Parts – Pack spare parts in containers or boxes bearing labels clearly designating the contents and the piece of equipment for which they are to be used.

C. Special Tools - For each type of equipment furnished, provide a complete set of special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.

Special tools are considered to be those which because of their limited use are not normally available, but which are necessary for the particular equipment.

D. Submit operation and maintenance manuals for items listed in pertinent other sections of these Specifications and for other items when requested by the Engineer. Provide manuals a minimum of 60 days prior to equipment start-up. Manuals shall comply with the requirements of Section 01770.

E. Submit Final Documentation, Equipment Startup Reports in accordance with Section 01770.

F. Plant Equipment Substitutions Which Cause Engineering and Contract Changes - Plant equipment installation as shown on the Drawings and as specified herein, are based on the equipment furnished by one manufacturer. Equipment which is offered as a substitute to the specific requirements of these Specifications, and which differs in detail and arrangement from that shown may require changes in design and construction. All costs which result from such changes in design and construction are to be borne entirely and unconditionally by the Contractor; said costs to include but not be limited to structural, piping, mechanical and electrical changes and all engineering costs incurred as a result of the substitution, in the revision of Drawings and Specifications, review of design changes by others, preparation of Change Orders, and any other costs directly resulting from said substitution.

END OF SECTION

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SECTION 11312

PACKAGED SUBMERSIBLE WASTEWATER PUMPING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. All labor, equipment, and materials necessary to furnish, install, test and place in operation submersible wastewater pumping units, controls, and other ancillary equipment, designed for raw wastewater service, as shown on the Drawings, and specified herein. Submersible wastewater pumps (two installed), base elbow, and all internal wiring and other ancillary equipment, designed for raw wastewater service, as shown on the Drawings, and specified herein.

2. Pump and level control systems including but not limited to adjustable/variable frequency drives (AFDs/VFDs) with bypass starters, system control panel, instrumentation and alarm systems.

3. Lift-out rail system

B. Related Sections

1. Section 01140 – Work Restrictions

2. Section 01310 – Coordination

3. Section 01330 - Submittals

4. Section 01770 – Closeout Procedures

5. Section 03485 – Precast Concrete Structures

6. Section 09900 – Painting

7. Section 11000 - Equipment – General

8. Division 15 - Mechanical

9. Division 16 – Electrical

1.2 REFERENCES

C. General - All electrical components shall conform to the requirements of the National Electric Code and must be listed and labeled "Approved" by Underwriters Laboratories (UL).

D. ANSI/HI (American National Standards Institute/Hydraulic Institute) Pump Standards

E. AFBMA (Anti-Friction Bearing Manufacturer Association)

F. ANSI (American National Standards Institute)

1. ANSI B16.1 – Cast Iron Flanges and Flanged Fittings

G. ASTM (American Society of Testing and Materials)

1. ASTM A48 - Standard Specification for Gray Iron Castings

H. ISO (International Organization for Standardization)

I. NEMA (National Electrical Manufacturers Association)

1.2 DEFINITIONS

A. Pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.3 SYSTEM DESCRIPTION AND OVERVIEW

A. Pump Station Major Components:

1. Pumping equipment, which shall be complete in every detail as herein specified, includes, but is not necessarily limited to, two (2) submersible, wet pit wastewater pumps, each with base elbows, explosion-proof inverter duty motors and power and control cables.

2. Pump control panel shall be as herein specified and installed as shown on the drawings.

3. Provide VFDs with bypass starters, primary and secondary liquid level devices, piping, valves, pump controls, and all specified electrical components and enclosures, and other related accessories as specified in their relevant specification sections.

4. The pumping system shall include pump retrieval guides and supports.

5. Primary and secondary liquid level devices.

6. The two pumping units which withdraw sewage from the pump station wet well. The discharge lines combine into a common header within the valve vault of the pump station, as shown on the drawings.

7. Piping, valves, and connections shall be provided to allow bypass of the station.

8. New precast concrete wet well and valve vault shall be provided for the pump station as shown on the drawings.

B. Pump and Level Control System

1. The pump and level control system shall be manufactured by Control Systems, Inc. (CSI) Jackson, MS and purchased by the Contractor for installation in the pump station. The system shall include the following components:

a. One duplex pump control panel enclosure with 3 Point Latch
b. Two VFD/Starter Panel Enclosures with 3 Point Latch
c. Pump Control Panel shall include the following:
   1) Duplex Pump Controller DC101F
   2) Frequency Drive Controller FDC101
   3) Voltage protection
   4) Float Test and status FT101
   5) Level meter controller MPCT6
   6) Motor Monitors MM101
   7) Duplex Controller Alarm Telemetry DCAT
   8) Mission Telemetry Unit – M150 Series Flat Pack Unit
   9) Pump Supplier - Temperature and Seal Failure Module
   10) Intrinsically Safe relays

d. VFD/Starter Panels shall include the following (Qty of 2)

1) Surge Protection
2) Main Breaker with Door Interlock
3) Power Distribution Blocks
4) Pump VFD with Bypass Starter
5) Selector Switches and Pilot Lights
6) Control Power Transformer
7) Control Power Transformer Fuse
8) Branch Circuit Breaker
9) Enclosure Exhaust Fan with Thermostat
10) Phase Monitor
11) Temperature and Leakage Relay as provided by the Pump Supplier.

e. Submersible Transducer with analog line filter

C. Level Control System Spare Parts

1) CSI DC101F Controller
2) CSI MPCT6 Controller
3) CSI FDC101 Controller
4) CSI MM101 Controller
5) Dwyer PBLT2-015 Transducer
6) VFD as provided
7) One type of each fuse

D. All interconnecting field wiring and devices required for a complete installation shall be provided by the Contractor.

1.4 SUBMITTALS

A. General

1. Comply with Section 01330 – Submittal Procedures.

B. Draft Warranty Documentation.

C. Product Data

1. For each type of product specified, which shall include literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the Specifications. This information shall be prepared specifically for the pumps proposed. Catalog sheets showing a family of curves will not be acceptable.

D. A marked-up version of this specification, which clearly indicates compliance with the provisions of this specification as well as any exceptions or deviations from the requirements of this specification. Contractor shall carefully review each paragraph and mark it with either a check indicating the submittal is in compliance with the requirements, or an "X" if the requirement cannot be met. For any paragraph marked with an "X", include a description of why the requirement is not applicable or a description of any deviations from the requirements.

E. Shop Drawings

1. Manufacturer's rating curves showing pump characteristics and pump data. These curves shall include plots of total dynamic head (ft) versus flow rate (gpm), horsepower (electrical) versus flow rate (gpm), and efficiency (water to wire) versus flow rate (gpm). Catalog sheets showing a family of curves will not be acceptable. Pump data shall include pump model and type, total pumping unit weight, maximum starts per hour allowable without pump or motor issues, motor rated horsepower, voltage, and current, and efficiencies (at full load, ¾ load, ½ load) and required minimum submergence for wet pit pumps. This information shall be prepared specifically for the pumps proposed. Catalog sheets are not acceptable.

2. Submit multiple pump curves covering speed ranges for the proposed variable speed pumps. Each curve shall plot total dynamic head (ft) versus flow rate (gpm), horsepower versus flow rate (gpm), and efficiency versus flow rate (gpm). This information shall be prepared specifically for the pumps proposed.

3. Details of fabrication, erection, and adjoining equipment interfaces for all equipment furnished under this Section.

4. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be provided.

5. Certified foundation, pump support, and anchor bolt plans and details.

6. Listing of spare parts to be provided.

7. Listing of special tools to be provided.

8. Manufacturer's electrical requirements for pumps, motors and pump monitoring system, including ladder-type project-specific wiring diagrams for interlock and control wiring, clearly indicating required field connections.

9. Submit Pump Control Panel drawings and documentation on control panel components.

10. Bearing life calculations.

11. Contractor shall verify all dimensions within the proposed pump stations and provide a drawing of each location confirming that the selected pumps, including proposed valves, pipe, and fittings, fit within the proposed pump station space as depicted on the Drawings.

12. Contractor shall verify all dimensions and locations of hatches and portable hoist for removal of pumps.

F. Quality Assurance/Control Submittals

1. A statement that each pump will function properly as installed with respect to the suction and layout as shown on the Drawings.

2. A "Letter of Compliance" stating that the characteristics of each pump (specifically naming the respective pumps), are such that they will not overload the specified motor horsepower under any head condition when operating at the specified maximum speed, and that the motor will not overheat at maximum turndown.

3. A certificate from the pump manufacturer stating that the installation of the pumping units is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit. The report shall also confirm that nothing in the installation will render the manufacturer's warranty null and void.

G. Test and Evaluation Reports

1. Certified copies of all required test results shall be submitted to the Engineer for approval prior to shipment. Factory Test results shall be provided for review after approval of pump equipment submittals but before shipment of the pumps to the project location. Field test reports shall be provided after field testing.

2. Certified factory test data including performance curves for each of the proposed pumps from shut off to maximum capacity, showing total dynamic head, efficiency (wire-to-water), brake horsepower (BHP), and minimum submergence. Data of tests and test points and results are required. All certified factory performance tests shall be performed according to the latest test ANSI/HI standard. Test shall demonstrate that the design points specified in the Schedule have been met.

3. Certified motor test data as described in Division 16, and performance specifications for the motor.

4. Vibration tests performed per manufacturer's recommendations.

5. Field test reports.

H. Closeout Submittals

1. Operation and Maintenance Manuals

   a. Provide O&M Manuals and Equipment Start-up Reports per Sections 01770 and 11000.

   b. Installation and operation instructions.

2. Warranty Documentation

3. Spare Parts

   a. Furnish with each pump and drive, the manufacturer's standard set of spare parts including at least the following:

      1) One set of all gaskets

      2) One impeller

      3) One bottom plate or suction cover insert ring (whichever is applicable to the submitted pump)

      4) One hard iron insert/wear ring (if part is included in the selected manufacturer's equipment)

      5) One set of mechanical seals

      6) One set of bearings

      7) One O-ring kit

      8) Other spare parts as recommended by manufacturer

   b. Spare parts shall be furnished packed in suitable containers and clearly labeled designating the contents and the unit for which they are intended.

   c. Furnish all special tools required for the maintenance of the new pumps.

1.5 QUALITY ASSURANCE

A. General

1. The pump manufacturer shall also furnish and be responsible for the electric motors, in accordance with Division 16. The pumping equipment shall be adequately and safely designed and constructed for heavy duty use and continuous operation (where required) at the pressures and under all conditions of service to which they may be subjected.

2. To assure unity of responsibility, the pumps, motors, and bases shall be furnished and coordinated by the pump manufacturer to assure a matched and working system. The pump manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps, motors, and bases.

3. The pumps covered under this Section are intended to be pumping equipment of proven ability as manufactured by a reputable manufacturer having experience in the production of such pumps. The pumps furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards. Each type of pump shall be the product of one manufacturer.

4. These Specifications direct attention to certain features of the pumping units, but do not purport to cover all the details of their design. The equipment furnished shall be designed and constructed equal to high quality pumping equipment manufactured by such firms as are mentioned hereinafter for the various types of pumps or approved by the Engineer.

B. Qualifications

1. The pumps specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and who has such pumps, or similar units, in successful operation for a minimum of five years.

1.6 DELIVERY, STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. On-site precautions must be taken by the Contractor to ensure adequate protection during storage.

1.7 WARRANTY

A. Final acceptance of all equipment furnished under this Section will be withheld until after the installation and satisfactory field testing. The Contractor shall warranty the work against defects of any kind for a period of one year after final testing and acceptance, or Substantial Completion, whichever occurs later.

B. In addition to the one-year Contractor warranty described above, the pump manufacturer shall provide a full 5-year, non-prorated warranty on all pumps supplied (pump, pump motors, etc.) Manufacturer's warranty shall be valid for 5 years from the date of start-up or 5 year and 6 months from the date of shipment for each unit and shall cover 100% of the cost of repairs for parts and shop labor (shop labor to include all repair labor with the exception of labor to remove and transport pumps).

C. Within the warranty period the manufacturer shall (at his own expense) promptly repair or replace any items as part of the delivered units which fail or simply wear producing a significant reduction in performance.

D. Should the painting system fail, or bubbling occur due to a defect in the painting system within the pump(s) warranty period, the pumps shall be pulled, prepped, repainted, and reinstalled at the manufacturer's expense, with no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. The pumping units required under this Section shall be complete including pumps, motors, and specified accessories. The pump manufacturer shall be responsible for the furnishing and performance of all equipment.

B. Parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially constructed for the work to be done. Ample room and facilities shall be provided for inspection, repairs, and adjustment.

C. Furnish all necessary foundation bolts, plates, nuts, and washers. Anchor bolts shall be Type 316 Stainless Steel, sized by the equipment manufacturer.

D. Brass or stainless-steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, serial number, and all other pertinent data shall be attached to each pump and motor. A special data plate shall be attached to the pump frame, which shall contain identification of frame and bearing numbers.

E. Comply with the requirements of Section 11000 (Equipment – General).

F. Provide lifting handle or lugs for equipment weighing over 100 pounds.

G. Electrical devices and equipment to be UL rated.

2.2 MANUFACTURERS AND PUMP MODELS

A. Sulzer (ABS): Model XFP 100G CB1 60 HZ; 20 HP; 1692 RPM;

B. Xylem (Flygt): Model NP 3153.095 HT FM; 20 HP; 1755 RPM;

C. Or equal.

D. The listing of a specific pump model herein in no way relieves the pump supplier from complying with all other requirements of this Section.

2.3 PERFORMANCE REQUIREMENTS

A. Refer to the Schedule(s) at end of this Section. Pumps shall be able to achieve the specified range of flows in gallons per minute (gpm) for specified Total Dynamic Head (TDH) and Net Positive Suction Head Available ($NPSH_A$). Pumps shall be suitable for continuous and intermittent duty operation unless otherwise specified. Pumping unit performance and construction shall conform to the ratings and nomenclature of the ANSI/HI Pump Standards.

2.4 SUBMERSIBLE-TYPE WASTEWATER PUMPS

A. Pump Assembly

1. Construction

a. Pumps shall be designed for handling raw wastewater. Major pump components shall be of ASTM A48, Class 35B or Class 40, with smooth surfaces devoid of blow holes or other irregularities. The casing shall have an integrally cast centerline discharge flange connection faced and drilled in accordance with 125-lb ANSI B16.1 Standard.

b. The lifting handle or lugs shall be constructed of stainless steel. All exposed nuts or bolts shall be Type 316 stainless steel. All metal surfaces coming into contact with the pumped fluid, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin or high solids epoxy paint finish on the exterior of the pump.

c. Sealing design for the pump/motor assembly shall incorporate metal to metal contact between machined surfaces. Critical mating surfaces where a watertight seal is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

d. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression are not acceptable. No secondary sealing compounds shall be used.

2. Impellers

a. Impellers shall be ASTM A-532 (Alloy III A) 25% chrome cast iron or ASTM A-48, Class 35B gray cast iron, dynamically balanced, semi-open, single vane or multi-vane, non-clog design capable of passing the minimum spherical solids size specified. Enclosed impellers shall not be considered. If Class 35B cast iron, provide hardening of bottom edge of impeller vane and wear plate surface.

b. The design of the pump and impeller arrangement shall promote self-cleaning, minimize clogging, be capable of handling solids, fibrous stringy material, heavy sludge, and other matter normally found in wastewater, and still promote efficiency. The impeller shall be dynamically balanced to provide smoot vibration free operation.

c. The impeller shall be locked to the shaft and held in place by a stainless-steel bolt, which cannot be loosened by torque from either forward or reverse rotation. The head of the impeller bolt shall be effectively recessed within the impeller bore or supporting washer to prevent disruption of the flow stream and loss of the hydraulic efficiency.

3. Volute

a. The pump volute shall be a single piece of gray cast iron, ASTM A-48, Class 35B or ASTM A-48, Class 40, non-concentric design with centerline discharge and smooth passages of sufficient size to pass any solid that may enter the impeller. Minimum inlet and discharge size shall be as specified under Section 2.3 Performance Requirements. Coordinate with piping design and confirm pump size will work with proposed piping layout. Additional piping changes to accommodate selected pumps are to be included in the scope.

b. Xylem/Flygt

The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged grooves. The spiral grooves shall provide trash release pathways and sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be of the same material as the impeller and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

c. Sulzer/ABS

The volute shall include an externally adjustable bottom plate. The bottom plate shall be designed with an inlet incorporating strategically placed cutting grooves and

outward spiral grooves on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge. The bottom plate shall be mounted to the volute with four stainless steel securing screws and four stainless steel adjusting screws to permit close tolerance adjustment between the bottom plate and impeller for maximum pump efficiency. Adjustment to allow for wear and restore peak pumping performance shall be easily accomplished using standard tools, and without requiring disassembly of the pump. The bottom plate shall be of the same material as the impeller and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

4. Pump Shaft

   a. The pump and motor shaft shall be a rigid integral unit, made from ASTM A479 S43100-T stainless steel or 420 stainless steel, of sufficient size to transmit the full driver horsepower with a liberal safety factor, accurately machined over its entire length and free from any harmful or damaging vibrations. Couplings shall not be acceptable. Shaft shall be adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system. Shaft shall be polished as necessary and have accurately machined shoulders to accommodate bearings, seals, and impeller. Carbon steel or chrome plated shafts shall not be considered adequate or equal.

5. Bearings

   a. Each pump shall be provided with bearings both radial and thrust, of the anti-friction type, of ample size to carry all loads imposed under continuous operation, minimizing shaft deflection and excessive heat buildup. Bearings shall be permanently lubricated. Bearings shall be designed in accordance with the ABMA standards. Minimum L_{10} bearing life when operating between 50% and 150% of best efficiency point (BEP) flow shall be as follows:

      1) L10 bearing life shall be 50,000 hours for pumps less than 20 HP.

      2) Minimum L10 bearing life 100,000 hours for pumps 20 HP and larger.

6. Seal Assembly

   a. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten or silicon carbide ring. The upper secondary seal, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten or silicon carbide ring.

   b. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Seals shall not require maintenance or adjustment.

7. Lubricant Chamber

   a. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-

leak seal shall be easily accessible from the outside. The seal system shall not rely on the pumped media for lubrication.

b. A moisture sensor probe shall be installed to detect the presence of water in the stator chamber. A corresponding relay designed to be mounted in any control panel shall be used in conjunction with the seal probe to detect moisture and energize a warning annunciation device in the control panel and/or cause the pump to shut down.

B. Motor

1. The pump motor shall be an induction type squirrel cage design. The rotor and stator shall operate in an air-filled and watertight NEMA B type housing. The stator windings and leads shall have a Class H insulation rating (365°F). The motor shall be designed for continuous duty while pumping fluids up to 104°F.

2. The motor shall be rated for inverter duty as defined by NEMA MG1 Part 31.

3. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of bolts, pins, or other fastening devices requiring penetration of the stator housing shall not be acceptable.

4. Thermal switches shall be embedded in each phase of the windings and set to open at 284°F. The thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor controls to shut down the pump during a high temperature condition.

5. The combined service factor as defined by NEMA MG1 shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%.

6. The motor horsepower shall be selected such that the unit is non-overloading over the entire range of the pump performance. The motors shall have capacity sufficient to operate the pumps throughout the operating range without exceeding the nameplate rating for current and power, unless otherwise is specifically indicated.

7. Motor shall be provided with lifting lugs.

8. The motor and pump shall be produced by the same manufacturer.

9. See schedule at end of specification for additional requirements.

C. Pump Support

1. Wet Pit Pumps

a. The pumps shall be supplied with a mating cast iron discharge connection. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two stainless steel guide bars extending from the top of the station to the discharge connection. Intermediate brackets shall be used for wet wells deeper than 20 feet. Lower, intermediate, and upper brackets shall be stainless steel. There shall be no need for personnel to enter the wet pit. The entire weight of the pump/motor shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall directly bear on the well floor.

b. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact, or by a field replaceable Nitrile

rubber profile gasket or O-ring. The pump shall be automatically connected to the discharge piping when lowered into position.

D. Cooling System

1. Wet Pit Pumps

a. The pump motors shall be sufficiently cooled by the surrounding pumped media without the need for a cooling jacket.

E. Motor Power Cables

1. Motor power cables shall be properly selected and sized for the electrical characteristics and loads and be of sufficient length to suit the installation without requiring splices. The pump power/control cable shall be FM or UL approved for use in hazardous locations and comply with the National Electric Code and State Specific Codes. The exterior jacket shall be capable of continuous submergence in sewage.

2. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

3. The cable entry design shall not require specific torque requirements to ensure a watertight seal.

4. The cable entry seal shall be comprised of a single elastomer grommet with washers located on either side. A compression fit of the grommet seals the cable and entry from the exterior fluid. The cable entry assembly shall allow easy replacement of cable by using the same cable entry grommet.

5. The cable entry junction chamber shall be separated from the motor by a waterproof sealed terminal board.

6. Provide motor with sufficient cable length to reach termination point shown on the drawings with at least 10 feet of excess cable (coiled up). Sufficient slack for pump removal onto a nearby work surface 10 feet away shall be provided for pump routine maintenance. The length of required cable shall be verified by the Contractor.

F. External Hardware and Pump Surface Coating

1. All exposed nuts or bolts shall be Type 316 stainless steel.

2. All metal surfaces coming into contact with the pumped fluid, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer, or in accordance with the pump manufacturer's recommendations, with a polyester resin or high solids two-part epoxy paint finish on the exterior of the pump.

3. The coating shall be resistant to sewage and other chemicals normally found in wastewater.

G. Pump Accessories Surface Preparation

1. Surface preparation, and prime painting, and finish painting of pump supports, and accessories (other than stainless steel or brass) are provided under this Section.

2. Surface preparation shall be SSPC-SP6, commercial blast. Shop prime and finish painting shall be the manufacturer's recommended coating systems for the intended service.

3. A minimum of one quart of touch-up paint shall be provided with the equipment.

H. Protection

1. Each pump motor shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. (See paragraph above regarding motor requirements).

2. A moisture detection device installed in the seal leakage chamber that will activate if there is excessive leakage into the chamber. A float type set at 50% chamber capacity or resistance type probe are acceptable.

I. Provide each pump with wiring in the pump power cables (or separate sensor cables as required) to connect the protective devices to the pump control panel in accordance with the Drawings and as outlined in Division 16.

J. Provide each pump with a Pump Control and Status Monitoring System capable of monitoring all the pump's protective devices. Furnish the required relay/control modules that make up this system to the supplier of the pump controls as specified herein or Division 13 or Division 16 as appropriate. Coordinate manufacturers recommendations with pump control design. The pumps protective devices shall include:

1. Thermal Switches –Shall be connected to the motor controls to immediately shut down the pump during a high temperature condition.

2. Detect Moisture – Shall be connected to the motor control to signal an alarm and the need to schedule an inspection. This may or may not result in the automatic shutdown of the pump.

3. Other devices as noted in the pump schedule.

K. Pump Accessories

1. Discharge pressure gauges shall be provided on discharge piping for each pump and shall meet the requirements of Section 15125.

2. All gauges shall be supplied with shut off and bleed cocks and diaphragms as required in Section 15125.

2.5 PUMP CONTROL PANEL

A. Contractor to contract with Control Systems, Inc. of Jackson, MI to provide the work under this section.

B. Provide a pump control panel and related instrumentation as described herein. Each pump control panel provided shall be in compliance with Division 16 including Section 16137 - Control Cabinets and Enclosures.

C. Each pump shall be provided with an adjustable frequency drive (VFD and with a ATL Backup Starter section) in accordance with Section 16265, which shall be wall mounted in their own separate NEMA 12 enclosures. Provide all accessories specified in 16265 with each VFD in the VFD enclosure. Each combination VFD/starter enclosure shall not exceed 30" wide to ensure the equipment will fit in the space allotted.

D. Pump control panel(s) shall be manufactured by a UL certified panel shop and shall bear either the UL508 industrial control equipment label or the UL 698A. Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations as required. Pump Control Panel(s) shall comply with the following:

1. NEMA 12 Indoor Enclosure shall be lockable.

2. Control the specified number of pumps for the location. Provide a primary controller that will start lag (standby pump) if lead pump faults while operating.

3. All Pilots to be the following color codes for Pilots used:

   a. Red – Alarms

   b. Green – Pump Running

4. Pump Control Panel shall include a pump controller to provide start/stop control of the pumps to maintain specified wet well levels and monitoring of the pumps. The pump controller shall meet the following requirements:

   a. Pump controllers shall be as manufactured by Control System, Inc. Jackson, MS.

   b. The pump controller shall be a standard "off the shelf" piece of equipment designed for this purpose and specifically suited for this type of industrial control panel service.

   c. The controller will incorporate the following:

      1) DC101F Pump Controller

      2) MPCT-6 Level Controller

      3) FDC101 Frequency Drive Controller

      4) MM101 Motor Monitor Control

      5) FT101 Float Status Board

      6) Alarm Telemetry Board DCAT Duplex Alarm Telemetry Board

5. The variable frequency drive equipment shall be programmed to respond to variations in the wet well in a manner wherein the hydraulic requirement will be accommodated in the pumping by using simple operator interface routines.

6. Upon power-up, the Controllers shall go through a pause period, which allows the analog signal and display to stabilize before any control, or alarm outputs are enabled. After the stabilization period, the control circuits of the Controller shall be sequentially enabled on a time-step arrangement.

7. An alternator shall operate the pumps in a First-on/First-off (FOFO) sequence and can be configured to sequence the pumps every start.

8. The alternator shall be capable of accepting pump failure and/or advance inputs and shall automatically transfer to the next pump sequence when failure condition input is sensed.

9. The alternator shall provide automatic transposing of the operating sequence of the control relays for the pumps on successive starts. The FOFO alternator sequencing shall operate such that the next load turned on is always the one that has had the longest opportunity to rest since its last operation.

10. The intent of the specification is that a standard controller be provided, with standard documentation. A custom written Description of Operation is not acceptable.

11. The pump controller operates on a 4-20mA input via a submersible pressure transducer. The controller shall be capable of being configured at the factory or jobsite to perform operating functions as described below, There will be no passwords required.

a. Duplex Pump operation.

b. Wet well pressure transducer rating (1.0-15.0 PSI).

c. Pump Alternation method.

d. Shut down upon Seal fail.

12. The pump controller will include the field adjustable set points. and provided as follows:

a. Low Water Alarm.

b. Pump Stop.

c. Lead Pump On.

d. Lag Pump On.

e. High Level Alarm.

f. High High Level Alarm

13. The equipment shall be protected from transient voltages and surges induced into the signal lines. The contractor shall provide a permanent earth ground connection to the panel ground lug in order to ensure proper operation of transient protectors.

14. Control panel wiring shall include identification numbers. Identification numbers shall be shown on the manufacture's control panel drawings.

15. The system shall incorporate UL 508 Industrial Control Panel approved elements as required of all components of these project panels and be furnished with all necessary hardware and software to accomplish level-responsive pump and alarm operation with software specifically suited to this project.

E. Provide a pressure transducer for the wet well to measure levels and perform primary pump control functions (start/stop of pumps and alarms).

1. Provide a pressure transducer as supplied by CSI.

2. The pressure transducer shall be the primary wet well level signal used for control of the pumps.

3. A means, readily adjustable by the Owner, shall be provided for setting the following activation levels when operating on the pressure transducer:

a. Provide Six control/activation levels:

1) High-High Alarm Level – Transmit high-high level alarm to the Mission Alarm System and switch to backup float control.

2) High Alarm Level – Transmits high level alarm

3) Pump On Level - Start lag pump

4) Pump On Level – Start lead pump

5) Pump Off Level – Shut off pumps

6) Low Alarm Level – Transmit low level alarm to the Mission Alarm System and switch to backup float control

7) Failure of the transducer shall automatically switch to back up float operation.

F. Provide the pump control panel with backup floats and related instrumentation. The backup floats controls shall be completely relay based and independent of the pressure transducer and the pump controller.

1. Four float switches shall be provided by CSI.

2. The float switch activation levels shall be generally the same as the pressure transducer control/activation level settings and alarms specified above.

3. The lead pump shall be as selected or shall be automatically alternated each time the lead pump is called on to start.

4. Alarms for High Level Alarm shall be transmitted when detected by the back-up High Level float switch when in float control, when manually selected or in Transducer Failure alarm, when in normal operation the Level Controller will generate the alarm though a designated set point, and the back-up floats will not be functional.

5. Alarms shall be transmitted when the High High Alarm float and Low Low Alarm float directly to the Mission Alarm System in normal operation or backup float control.

6. If the high level alarm float is activated, the lead and lag pumps shall be started (if they are not already running) and shall remain running until the wet pit is pumped down to the "pump off" level.

7. If the low alarm float is activated, the pumps shall be shut off.

G. Provide pump control panel with intrinsically safe circuits for pressure transducer and floats.

H. Provide the pump control panel with adjustable time delay capable of delaying the start of each pump as follows:

1. Delays are manually adjustable over a minimum range of 0 to 90 seconds

2. The Lead pump cannot restart until at least 10 seconds (adjustable) after power is restored to the control panel (e.g., power transition to or from the generator).

3. The Lag pump cannot restart until at least 10 seconds (adjustable) after the lead pump has been started.

I. Each Pump Control Panel shall include the following:

1. Main Circuit Breaker interlocked with panel door

2. Control Power Transformer

3. Liquid Level Display(s)

4. High-High Wet Well Level Alarm Lamp

5. Low Low Wet Well Level Alarm Lamp

6. Lead Pump Selection Switch (Pump 1/Pump 2 and Alternate Selector)

7. Means to set the activation levels when on pressure transducer control

8. Backup Float Controls

9. For each installed pump provide the following:
    a. Elapsed Time Meter
    b. Hand-Off-Auto Selector Switch (mounted on the VFD enclosure)
    c. Pump "On" Lamp
    d. Pump "Off" Lamp
    e. Pump "Seal Leak" Alarm Lamp
    f. Pump "Thermal Overload" Alarm Lamp
    g. Pump "Fault" Alarm Lamp (Starter Overload/Soft Starter Fault)
10. The following signals shall be provided for interfacing with the Town's Mission/SCADA system:
    a. Dry Contact Outputs rated for 120VAC/24VDC for the following status where the pump controller does not have an intergraded output:
        1) Low Low Wet Well Alarm (Float with the integrated output)
        2) High-High Wet Well Alarm (Float with the integrated output)
        3) Transducer Failure
        4) Pump 1 Running
        5) Pump 2 Running
        6) Common Alarm
        7) Loss of Control Power
11. The pump controller will include the field adjustable set points. and provided as follows:
    a. Low Level Alarm
    b. Lead pump stop.
    c. Lead pump start.
    d. Lag pump Start.
    e. High Level 1 Alarm.
    f. High Level 2 Alarm.
12. Main Circuit Breaker
    a. A molded case circuit breaker shall be provided as the main power disconnecting device for the control panel. The breaker handle shall be mounted on the door and shall be mechanically interlocked with the panel door to prevent opening the door while the breaker is on (a means to bypass this safety interlock with a flat head screwdriver shall be included).
    b. Provide in accordance with Section 16410.
13. Control Switches and Pilot Lights (Push-to-Test)

a. Provide in accordance with Section 16490.

14. Control Relays

a. Provide in accordance with Section 16490.

2.6 VFDS WITH BYPASS

A. The two (2) VFD/starter panels will be installed remote from the Pump Control Panel.

B. For each VFD, provide equipment/controls as specified in 16265 and as shown on the Pump VFD Wiring Diagram (Drawing E-603).

C. Provide one across the line Bypass Starter system with each VFD in the VFD enclosure.

D. VFD enclosure width shall be limited to 30" to ensure it will fit in the allotted space.

E. Pump Circuit Breakers

1. A thermal magnetic circuit breaker shall be supplied as branch circuit protection for each pump motor. The circuit breaker shall be operable through the operator's door of the enclosure.

2. The circuit breaker shall be properly sized to protect the control circuit conductors, motor starter and the motor against over current due to short circuit or grounds

3. Provide in accordance with Section 16410.

F. Install the motor overtemperature/Seal Leak monitor in the VFD enclosure as shown on the wiring diagram.

G. Provide a 5% line reactor, surge protector, control power transformer, speed potentiometer and other switches, pilot lights and wiring as specified in 16265 and as shown on the wiring diagram, in accordance with 16137 & 16490.

2.7 LIFT-OUT SYSTEM – WET PIT SUBMERSIBLE PUMPS

A. A slide away coupling shall be provided for each wet pit submersible pump to allow the pump to be installed or removed without requiring personnel to enter the wet well. The coupling shall consist of a discharge elbow securely fastened to the floor of the chamber, a moveable bracket that bolts to the pump discharge flange and mates with the discharge elbow, and a system of guide pipes to guide the pump and moveable bracket from the discharge elbow to the access cover in the top of the chamber. Guide pipes shall be securely affixed to top of concrete structure hatch frame.

B. The lift-out system shall consist of the following components:

1. Guide rails

2. Intermediate guide rail brackets

3. Lifting chain/cable with grab link

4. Upper guide rail bracket

5. Slide bracket

6. Rail support/pump discharge elbows

7. Anchor bolts

C. Each guide rail system shall be constructed of schedule 40 type 316 stainless steel rails. Intermediate guide rail brackets shall also be type 316 stainless steel and shall be sized and installed with spacing per the manufacturer's requirements.

D. All rails, brackets, anchor bolts, lifting chain/cable and miscellaneous fasteners for the guide rail system shall be type 316 stainless steel. Lifting chain/cable working loads shall be 100% greater than the weight of each pumping and motor assembly.

E. All anchor bolts shall be 316 stainless steel and shall be of ample size and strength for the purpose intended. All anchor bolts shall be installed in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 GENERAL

A. Provide required field measurements to facilitate the installation of the pump systems.

B. All adjustments necessary to place the equipment in satisfactory working order shall be made at the time of the field testing.

3.2 INSTALLATION

A. Installation of pumps, pipes, valves, and appurtenances shall be strictly in accordance with the recommendations and instructions of the manufacturer and located as shown on the Drawings or as approved by the Engineer. Supervision of installation and testing of equipment by the manufacturer's representative shall be provided in accordance with the requirements of this Section.

B. Installation shall comply with the requirements of Section 03485 to provide a fully functioning submersible pumping facility.

C. Pump Manufacturer shall coordinate with Contractor to confirm Pump Station is ready to accept Pumps for field installation and to ensure that the proposed pumps can be accommodated in the pump station.

D. Pump Manufacturer shall coordinate with Contractor for pump base to be installed in the Pump Station.

E. It shall be the responsibility of the Contractor to coordinate the Work included under this Section with other related Work to ensure that all the equipment shall operate to perform the designated functions in a proper and acceptable manner.

F. Pipe and fittings shall be installed in accordance with the Drawings and Specifications regarding excavation and backfilling, alignment and grade, trench preparation, pipe laying, blocking, anchoring, testing, protection, and cleaning.

G. Tap pipe or fittings and set discharge pressure gauge assemblies where shown on Drawings.

H. Connect discharge piping without imposing strain to pump flanges.

I. Anchor bolts shall be accurately placed using equipment templates.

J. Pump control panel indicators shall be mounted at operator-level height, maximum of 5-ft above the finished floor where operators will stand to access the control panel.

3.3 TESTING

A. General

1. Provide a certificate from the equipment manufacturer stating that the installation of his equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit shall be submitted. The report shall also confirm that nothing in the installation will render the manufacturer's warranty null and void.

B. Factory Testing

1. Submit certified factory test data showing the results of factory testing for each of the proposed pumps including performance curves for each pump from shutoff to maximum capacity, showing total dynamic head, hydraulic and overall efficiency, brake horsepower, required NPSH, and minimum submergence.

2. Pumps shall be factory tested at a minimum of six head/capacity points including shutoff head and maximum capacity as required by ANSI/HI Pump Standards to ensure pumps are tracking along the certified pump curve.

   At least one point of the six shall be taken as near as possible to each specified condition. The results of all tests, including plots of the certified pump performance curves (specifically showing the test points) depicting head, capacity, brake horsepower and pump efficiency shall be submitted to the Engineer for approval. Acceptance of the pump test results will be judged at rated capacity and rpm with applicable total head and efficiency as +5%, -0%. Minimum efficiency shall be as specified.

3. Pumps shall be hydrostatically tested at 1.5 times the shut-off head internal pressure.

4. Motor and cable insulation shall be tested for moisture content and defects before and after the hydrostatic tests.

5. Submit a certified written report prepared by the manufacturer with the details and results of the tests.

C. Field Testing

1. Field test shall not be conducted until such time that the pump installation is complete and ready for testing.

2. After the complete pumping units and appurtenant equipment have been installed, and the units have been inspected, tested, adjusted, and placed in proper operating condition under the direct observation of the pump manufacturer's representative, the pumping equipment shall be field-tested by the Contractor in the presence of the Engineer.

   Pumps shall be field tested at a minimum of four head/capacity points including shutoff head and maximum capacity. Test points shall also be taken as near as possible to each specified design condition.

3. The tests shall demonstrate fitness for the service specified and the ability of the pumping units to operate without vibration or overheating when operated to meet the performance requirements specified.

4. Record driving motor voltage and amperage measured for each phase for each test point.

5. The results of field tests, including plots of the field test points on the certified pump performance curves (from the factory test) shall be submitted to the Engineer for approval.

6. Operate each of the pumps for a minimum of two weeks under normal operating conditions or for 24 hours of total runtime at maximum capacity, whichever comes first,

without malfunction, prior to acceptance. Do not demobilize bypass pumping equipment until all pumps have been accepted.

7. Overnight supervision shall be provided as required.

8. Adjust, realign, or modify units and retest**,** if necessary.

9. Field vibration testing shall be performed using calibrated instruments to confirm that vibration limits comply with Hydraulic Institute Standard 11.6 (current edition). Calibration certificates must demonstrate calibration has been performed within 1 year of the field testing date.

10. Correct or replace promptly all defects or defective equipment revealed by or noted during testing, and if necessary, repeat the tests until satisfactory results are obtained. Furnish all labor, piping, equipment, and materials necessary for testing.

11. In the event the equipment fails to meet any of the requirements specified above, make the necessary changes, and retest the equipment. If the equipment remains unable to meet the specified requirements to the satisfaction of the Owner, remove and replace the equipment with satisfactory equipment at no cost to the Owner.

D. Manufacturer's Field Services

1. Coordinate the services of a qualified field service engineer provided by the manufacturer for start-up, inspection, and testing.

2. Provide the services of a manufacturer's factory-trained technician to train the Owner on the operation, calibration and maintenance of equipment supplied under this Section. Provide the Owner with a minimum 7 days' written notice of planned operator training.

   Provide a minimum of 8 hours of field service at the pump station/location by an authorized, factory trained representative of the pump manufacturer for installation and start-up supervision for the pumps and pump controls. Services shall include, but not necessarily be limited to, inspection of the completed installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, and supervision of all field testing, and training in the operation and maintenance of all equipment provided under this Section, as well as activation of the Warranty.

SCHEDULE 11312-1 - Performance Data		
Pump Reference		**P-101 and P-102**
Pump Type		Wet-Pit Submersible Non-Clog Centrifugal, Solids Handling Wastewater Type for Continuous/Intermittent Operation
Basis of Design		Sulzer/ABS and Flygt/Xylem
Number of Pumps to be Provided		2 (1 Duty, 1 Standby)
Minimum Impeller Diameter		250 mm
Minimum Pump Suction/Discharge Diameter		4 inches / 4 inches
Minimum Spherical Solid Size		3 inches
Maximum Rated Speed (Nominal)		1800 rpm
Maximum Motor Size, Maximum Full Load Amps		20 hp, 25.5 Amps
Other Motor Requirements		Inverter Duty as Defined by NEMA MG1 Part 31. Premium Efficiency Listed by Factory Mutual or UL as explosion-proof (Class I, Division 1, Group C and D hazardous locations.)
Power Requirements		480 V / 3 Phase / 60 Hz
Maximum Assembled Pump Weight (including Motor & Cables)		900 lbs
Minimum Pump Shutoff Head		116 feet
Approximate Static Head Range		24.83 feet to 29.53 feet (Suction and Discharge Liquid Level Dependent)
Single Pump at Full Speed Design Condition	**Design Point**	481 gpm @ 82 ft TDH
	Maximum $NPSH_R$	15feet
	Minimum Hydraulic Efficiency	62%
	Minimum Wire-to-Water Efficiency	56% (guaranteed to HI Grade 1U)

Notes:

1. Motor shall be non-overloading over entire pump curve.
2. Each pump shall be capable of delivering the specified Design Points while operating within the pumps Preferred Operating Range (POR) as defined by ANSI/HI.
3. Pump shall be capable of at least 72% turndown (to 43.2 Hz) without clogging, when used in conjunction with adjustable frequency drives.
4. The NPSHA value(s) specified above are based on a Max Liquid Temperature of 75°F and a pump inlet diameter as noted and the anticipated wet well elevations which will vary from a static water level above the concrete floor under the submersible pump. Changes in the pump suction size and related fitting will changes the TDH and NPSHA which must be considered in supplier's pump selection.
5. Pumps shall fit within the space provided in the configuration as shown on the drawings with sufficient vertical and lateral space for proper function. Pump shall have maximum dimensions such that they can be removed through a hatch with dimensions not exceeding 5'–0" length x 3'–6" width hatch opening, without disassembly. Pump shall be removed from the wet well shown on the drawing, using the manufacturer supplied slide rail, chain and grab link system in conjunction with a davit crane. A crane hook height of no more than 6'–0" above the floor or hatch cover or as otherwise indicated on the drawings, shall be required to remove, and move the pumps.

END OF SECTION

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SECTION 13121

PRECAST CONCRETE BUILDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Provide all labor, materials, equipment and services necessary to furnish, install, and place in operable condition, a factory-built building together with all ancillary equipment. The building shall be a prefabricated, reinforced, modular, concrete building. The building shall have minimum interior dimensions of 11'-0" wide x 20'-0" long x 9'-0" high. If the Contractor utilizes equipment other than what is designated as the basis of design on the drawings then building size may need to increase to provide similar clearances around equipment. The Generator building, shall be off-loaded, installed and connected by the contractor at the site with minimal connections required. The precast manufacturer shall provide a building with the following items completed:

   a. Precast single-level concrete building enclosure

   b. Electric heating, ventilation, lighting, and power

   c. Doors and louvers

   d. Electrical equipment including wiring, pipe and electoral conduit for lighting, circuit breakers, panelboards, wall penetration sleeves and mechanical seals, junction, pull, and terminal boxes.

   The Generator building utility connections and foundation systems shall be completed in the field.

B. Related Sections

1. Section 02315 - Excavation, Backfilling, and Compaction
2. Section 02320 - Borrow Materials
3. Section 03200 - Concrete Reinforcement
4. Section 03300 - Cast-in-Place Concrete
5. Section 06100 – Rough Carpentry
6. Section 07210 – Building Insulation
7. Section 07310 – Asphalt Shingles
8. Section 07463 – Fiber cement Siding
9. Section 07620 – Sheet Metal Flashing And Trim
10. Section 08110 – Steel Doors and Frames
11. Section 08710 – Door Hardware
12. Section 09900 – Painting

13. Division 15 - Mechanical

14. Division 16 - Electrical

1.2 REFERENCES

A. Connecticut State Building Code, most recent edition, with Amendments.

B. International Mechanical Code – IMC 2021, with Amendments.

C. International Energy Conservation Code – IECC 2021, with Amendments.

D. National Electrical Code

E. American Concrete Institute (ACI)

1. ACI 301 - Specifications for Structural Concrete for Buildings, (included as part of this specification).

F. Concrete Reinforcing Steel Institute

1. "Manual of Standard Practice"

G. American National Standards Institute (ANSI)

1. "Building Code Requirement for Minimum Design Loads in Buildings and Other Structures"

H. American Society for Testing and Materials (ASTM)

1. ASTM A185 - Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

2. ASTM A615 - Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

3. ASTM C33 - Standard Specification for Concrete Aggregates.

4. ASTM C39 - Standard Method of Testing for Compressive Strength of Cylindrical Concrete Specimens.

5. ASTM C150 - Standard Specification for Portland Cement.

6. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

7. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

I. NFPA – National Electrical Code

J. Prestressed Concrete Institute (PCI)

1. MNL-116 - Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.

1.3 SUBMITTALS

A. Product Data

1. Submit manufacturer's product data, installation and start-up instructions, use limitations and recommendations for each material used. Provide certifications stating that the materials comply with the requirements.

B. Building

1. Shop drawings, prepared and sealed by professional Engineer registered in Connecticut, shall be submitted in accordance with the requirements of the project showing dimensions, sizes, thickness, materials, finishes and methods of assembly. Submit Manufacturer's technical data for all building hardware and equipment. All work shall be fabricated and erected in accordance with the Manufacturer's drawings.

2. Structural design calculations for the building shall be prepared and sealed by a registered professional Engineer in Connecticut and shall be submitted for approval prior to fabrication.

a. Structural Design

b. Provide a certificate of Compliance stating that the building supplied meets either the prescriptive or the performance requirements of the 2021 International Energy Conservation Code or the current prevailing version of this Code.

C. Shop Drawings

1. The drawings show a generalized configuration for the Generator building. Submittals shall include separate scaled, detailed drawings for the precast concrete structure. Prepare drawings showing the proposed arrangement of work.

2. Indicate dimensions, required clearances, openings, and method of assembly of components.

D. Wiring Diagrams

1. Submit manufacturer's electrical requirements for Septage Receiving building including ladder-type wiring diagrams for interlock and control wiring, clearly indicating required field electrical connections.

E. Operational and Maintenance Manual

1. Submit Operating and Maintenance Manual and parts lists for controls, and accessories, including "trouble shooting" maintenance guide. Include this product data, shop drawings, and wiring diagrams in maintenance manual.

1.4 SYSTEM DESCRIPTION

A. The factory-built building precast concrete building together with all ancillary equipment as described herein shall be factory installed. The building shall be internally pre-wired and tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL listing mark for industrial control panels.

B. Minimum strength of concrete shall be 5,000 psi at 28 days. Reinforcing steel shall conform to ASTM A615 Grade 60. Joints between structures sections shall be sealed with preformed flexible, vulcanized rubber butyl rubber sealant.

C. The Precast Building Manufacturer shall Furnish and install to their structure:

1. HVAC equipment, supports, insulation, and control panels
2. Interior fuel oil piping and termination at the generator
3. Electrical panelboards, transformer, disconnect switches, main circuit breaker and meter socket
4. Electrical conduit and wire, boxes, and receptacles
5. Generator and ATS
6. Interior and Exterior building mounted lighting and supporting lighting controls

1.5 QUALITY ASSURANCE

A. The Precast Concrete Building Manufacturer shall have a minimum of 5 years experience in building fabrication. In addition, the Manufacturer shall have made no less than 10 buildings similar to the one on this project. Evidence must be submitted to verify that these requirements are met prior to being deemed an acceptable manufacturer.

1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and participate in its Plant Certification Program.
2. The Building Manufacturer must maintain "Certification in Good Standing" for product groups B & C, under the PCI plant certification program.

B. Source Quality Control

1. One set of 4 compression test cylinders shall be made for each day's production for each type of precast Unit. Make compression test specimens in accordance with ASTM C31. Obtain concrete for specimens from actual production batch. Cure specimens using same methods used for curing precast units.
2. Two specimens shall be tested at 28 days for acceptance, one shall be tested prior to removing forms, and one shall be tested at seven days. Compression tests shall be conducted in accordance with ASTM C39. Do not remove precast units from forms unless strength tests have been completed and results are equal to, or greater than, minimum required values.

C. The Engineer shall have the right to inspect or test any materials during fabrication in the factory. At the option of the Engineer, certified tests of materials may be accepted in lieu of field tests. Provide 7-day written notification to the Owner's Project Representative prior to casting the structures. The Engineer may sample the concrete and inspect reinforcement placement at the time of fabrication.

D. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture, or on the work 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 Specifications 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. All materials, which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

E. At the time of inspection, the materials will be carefully examined for compliance with these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

F. Imperfections in sections may be repaired, subject to the approval of the Owner's Project Representative, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall 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.

G. All electrical wiring and equipment shall be installed in conformance to the National Electrical Code.

H. The Contractor shall be responsible for obtaining and paying for all applicable permits and inspections for the building and electrical installations, including but not necessarily limited to the general electrical inspection and fire department inspections.

1.6 DELIVERY, STORAGE AND HANDLING

A. The building shall be stored on dunnage placed at the proper locations to prevent cracking, distortion, or any other physical damage.

B. The building shall be shipped F.O.B. jobsite by the Manufacturer. It shall be provided with Burke lifting fixtures for lifting and setting the building without incurring damage to the walls or roof.

C. The Building Manufacturer shall provide all cables and lifting hardware for use in off-loading and setting the building.

1.7 GUARANTEE

A. The manufacturer of the equipment shall guarantee that for one year from the date of project acceptance by the Owner, all equipment shall be free from defects in design, material and workmanship. The manufacturer shall replace in kind any component, major or accessory, supplied as part of the packaged building, whether of his or other manufacture during the guarantee period at no cost to the Owner. Included in the parts replacement are all materials or labor excepting those items which are normally consumed in service such as light bulbs.

PART 2 PRODUCTS

2.1 PRECAST BUILDING

A. Acceptable Precast Building Manufacturers

1. Manufacturers - Subject to compliance with requirements, provide prefabricated unit of one of the following:

a. United Concrete Products (Contact: Steve Riccitelli: (203)-269-3119)

b. Oldcastle Infrastructure/EASI-SET™ Buildings Division (Contact: David Worthington: (215)-896-7069)

c. Shea Concrete Products (Contact: Frank Dimando: (978)-752-2118)

d. or equal.

B. The precast building enclosure shall be a factory assembled, modular structure and requiring no additional assembly other than as follows:

1. Field installation of the prefabricated roof trusses, roof sheathing, FRP laminated plywood ceiling, and shall be in accordance with specification 06100 – Rough Carpentry.

2. Field installation of wall and ceiling rigid board insulation shall be in accordance with specification 07210 – Building Insulation.

3. Field installation of the asphalt roof shingles shall be in accordance with specification 07310 – Roofing Shingles.

4. Field installation of the cement board siding and trim shall be in accordance with specification 07463 – Fiber Cement Siding.

5. Field installation of the roofing flashing and trim in accordance with Section 07620– Sheet Metal Flashing and Trim.

6. Field installation of related field wiring to connect to the building panel and the field installed pieces of equipment.

C. The building shall be designed to meet the loading requirements specified on the drawings.

D. Provide positive anchorage of the precast building to the foundation to resist the uplift and sliding forces that result from the application of the prescribed loads in accordance with building code requirements. Anchorage to provide minimum factors of safety as follows:

1. Against sliding – 1.5

2. Against overturning – 2.0

E. The precast building shall have minimum interior dimensions of 11'-0" wide x 20'-0" long x 9'-0" headroom from the floor to the underside of the precast concrete roof slab. All sections shall be constructed of steel-reinforced precast concrete with the following critical elevations:

1. Approximate Top of Precast Concrete Roof Elevation 520.91' +/-

2. Top of Foundation Wall Elevation 510.83' +/-

3. Finished Grade Elevation 511.00' +/-

4. Finished Slab Elevation 511.50'

F. The building shall have a minimum concrete thickness as follows:

1. Roof - 5.0 inches

2. Floor - 6.0 inches

3. Wall - 4.0 inches

G. The precast concrete building shall be panelized such that the roof, floor, and walls are assembled at the manufacturer's facility and the building is shipped fully assembled. Precast concrete buildings with the roof, floor, and walls cast monolithically at manufacture will also be allowed in accordance with 2.1.B.

H. Fire Resistance

1. The building shall calculate at a one-hour fireproof rating without affecting the structural properties of the building.

I. Bullet Resistance

1. The building shall be designed to be maintenance-free and vandal resistant. The building shall be designed for bullet resistance consistent with ANSI/VL threat levels 1 – 4. The bullet envelope shall be bullet proof to a 308 rifle and a steel bullet at 25 feet.

2.2 EXTERIOR BUILDING FINISH

A. The exterior surfaces shall be smooth steel trowel natural color concrete.

1. Fiber cement board siding and trim shall be field applied to the building in accordance with specification 07463.

2.3 EXTERIOR BUILDING FINISH

A. The interior surfaces shall be smooth steel trowel natural color concrete.

1. The interior walls will be painted in the field in accordance with specification 09900.

2. The FP laminated plywood ceiling shall be field installed over rigid insulation in accordance with specifications 06100 and 07210.

2.4 CONCRETE MATERIALS

A. The concrete shall have a 28-day compressive strength (f'c) of 5,000 psi and shall meet the requirements of specification 03300 – Cast-in-Place Concrete.

2.5 FORM MATERIALS

A. Formwork shall be in accordance with specification 03100 – Concrete Forms and Accessories.

2.6 REINFORCEMENT

A. Reinforcement shall be in accordance with specification 03200 – Concrete Reinforcement.

2.7 FABRICATION

A. General - Fabricate the precast concrete building complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances unless noted otherwise of PCI MNL-116, and as specified for types of units required. Fabrication tolerances (unless more restrictive in PCI MNL-116):

1. Units shall be manufactured and installed so that each unit after erection complies with the following dimensional requirements.

Item	Maximum Deviation
Span	1/8"
Thickness	1/8"
Openings	1/4"
Out of Square	1/8" per 10'

Bowing and Warpage	1/360 span
Location of Built-In Items:	
Inserts, Bolts, Pipe Sleeves, etc.	3/8"
Flashing Reglets	1/4"

B. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

C. Exposed surfaces shall be smooth finished. Form offsets and fins shall be removed and ground smooth. Air pockets and holes larger than ¼ inch in diameter shall be filled with sand-cement paste.

D. All surfaces of the precast structure shall be smooth, even and free from roughness, irregularities and other defects, and shall be suitable for receiving the interior and exterior finishes specified elsewhere herein.

E. Exposed edges shall be sharp, straight and square (or Chamfered) and all flat surfaces in a true plane. Warped, cracked, broken, spalled, stained, or otherwise defective units shall be replaced at no additional cost to the Owner.

F. Identification - Provide permanent markings to identify pickup points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in finished structure.

G. Fabricate precast concrete units as detailed in accordance with approved erection drawings and to meet requirements of these specifications.

H. Provide embedded anchors, insets, plates, angles, and other cast-in items with sufficient anchorage and embedment for design requirements. Provide adequate inserts for lifting and handling precast units. Weld metal inserts in accordance with AWS D12.1. Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete.

I. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

J. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

K. Delay detentioning of prestressed units until concrete has attained at least 70% of design stress, as established by test cylinders.

1. If concrete has been heat-cured, perform detentioning while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

2. Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

2.8 GROUT MATERIALS

A. Non-metallic Shrinkage-Resistant Grout - Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage

compensating agents, plasticizing and water reducing agents. Compressive strength not less than 7,000 psi. at 28 days.

1. Products - Subject to compliance with requirements, provide one of the following:

   a. Euco N.S.; Euclid Chemical Co.

   b. Crystex; L&M Construction Chemicals

   c. Masterflow 713; Master Builders

   d. Five Star Grout; U.S. Grout Corp.

   e. Upcon; Bostik Construction Products

   f. or equal.

2.9 ACCESS DOOR AND FRAME

A. The building shall be outfitted with one double door with a pair of 3′-0" x 7′-0 doors.

B. Please refer to Division 8 – Specification Section 08110 – Steel Doors and Frames for the door and frame requirements.

C. Please refer to Division 8 – Specification Section 08710 – Door Hardware for the door hardware requirements.

D. The Contractor shall provide temporary locks for approved cylinders for the construction period. The Contractor shall provide and install a Town of Vernon master keyed cylinder lock at final completion.

2.10 INSULATING MATERIALS

A. Building insulation shall be installed in the field and be in accordance with specification 07210 – Building Insulation.

2.11 ROOFING MATERIALS

A. The roof trusses, roof sheathing shall be in accordance with specifications 06100.

B. Roof shingles shall be in accordance with specification 07310 – Asphalt Shingles.

2.12 SHEET METAL FLASHING

A. Sheet metal flashing shall be in accordance with specification 07620 – Sheet Metal Flashing Trim.

2.13 SLEEVES AND SEALS

A. The precast building manufacturer shall provide all wall sleeves and seals. The Contractor is responsible for sizing and coordinating all sleeve locations and elevations.

B. Wall sleeves shall have seep rings placed on the center of the sleeve and project three inches. Wall sleeves shall be the same length as the wall thickness. Sleeves shall be sized to accommodate compression bolted linked rubber sealing devices. Conduit shall be sealed watertight utilizing compression bolted conduit seals.

2.14 ANCHOR BOLTS AND FASTENERS

A. All anchor bolts and fasteners shall be 18-8 stainless steel and shall be of ample size and strength for the purpose intended. All anchor bolts shall be installed in accordance with the manufacturer's instructions.

2.15 ELASTOMERIC JOINT SEALANT

A. Install elastomeric sealant at perimeter joints of the exterior concrete wall and frames of doors, louvers, and wall fans to form a weatherproof, watertight seal.

B. Provide a one-part nonacid-curing silicone sealant - Type S - Grade NS - Class 25. Comply with joint sealant manufacturer's printed installation instructions. Acceptable products include:

1. Chem-Calk N-Cure 2000 - Bostik Construction Products Div.
2. Dow Corning 790 - Dow Corning Corp.
3. Silglaze N SCS 2501 - General Electric Co.
4. 864 - Pecora Corp.
5. Spectrum 1 - Tremco, Inc.
6. or equal.

2.16 HEATING AND VENTILATION COMPONENTS

A. Design Criteria:

1. Exterior design temperatures:
   a. Winter: Per ASHRAE 99.6% design heating temperature
   b. Summer: Per ASHRAE 1% design cooling temperature
2. Interior Design Conditions:
   a. Winter: 65° F
   b. Summer: 80° F
3. Air Intake and Exhaust Louver, design requirements:
   a. Free Area velocity intake: max 400 fpm
   b. Free Area velocity exhaust: max 800 fpm
4. Heating and cooling equipment shall be locked out when station operates on generator power.

B. HVAC component requirements:

1. General: run, stop and fault indicators shall adhere to client standard.
2. Louvers:
   a. Drainable aluminum with Kynar 500 or equivalent finish.
   b. Louvers shall be AMCA 540 and 550 rated
   c. Provide with aluminum bird screen.
   d. Louver manufacturers: Ruskin, Construction Specialties, or equal

3. Automatic Control Dampers

   a. Provide motorized dampers for all louver openings.

   b. Passive back draft dampers are not acceptable.

   c. Dampers shall be opposed or parallel blades as shown on drawings.

   d. Provide recirculation of generator cooling air to prevent building overcooling during cold period generator operation.

   e. Dampers 9 sqft and larger not connected to insulated ductwork shall be internally insulated.

   f. Plenums between any damper and the outside wall shall be insulated to R-8 with fiberglass board.

   g. Damper serving louvers without duct connection, shall be installed within the wall cavity to limit space obstructions.

4. Cooling/Heating

   a. Split Heat Pump with capacity per drawing schedule.

   b. Provide equipment wall mounting supports.

   c. Heat Pump manufacturers: Mitsubishi, Daikin, or equal.

5. Heating:

   a. Heat pump as first stage with electric unit heater as second stage and backup.

   b. (1) 4kw electric unit heater, manufactured by Indeeco, Qmark or equal, with a wall mounted heating thermostat in the space.

6. Refrigerant Piping and condensate piping:

   a. All refrigerant lines between outdoor and indoor units shall be, refrigeration grade copper tubing, ACR Type, meeting ASTM B280 requirements.

   b. Insulation:

      1) Closed Cell Elastomeric

      2) For refrigerant piping line sets utilize elastomeric insulation with flexible coextruded polymeric jacket for abrasion resistance.

      3) Vapor and liquid piping shall be insulated individually. Wrapping piping together is not acceptable.

      4) Pipe 1 inch and smaller: 1 inch

      5) Pipe 1-1/4 inches and larger: 1-1/2 inches

      6) Exterior piping shall be wrapped with aluminum jacket where not protected by a line set cover.

      7) Interior piping shall be wrapped in white PVC jacket.

      8) Maintain integrity of vapor-barrier jackets on pipe insulation and protect to prevent puncture or other damage.

9) Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

10) Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

11) Butt pipe insulation against pipe hanger insulation inserts.

12) Install insulation continuously through hangers.

c. Hangers and Supports:

1) Clamps and hangers for insulated piping shall maintain the system vapor barrier and insulation thickness.

2) Provide clamp type compatible with insulation material and thickness. Clamp insert to secure pipe shall be low-heat-conducting material.

3) Direct contact of metal clamp to piping is not acceptable.

4) Reduction of pipe insulation thickness not acceptable.

C. Controls:

1. All setpoints shall be user adjustable.

2. All control components (sensors, switches, thermostats) shall be 24V.

3. Ventilation control panel shall be designed per electrical requirements below. Sensors, switches, or control interfaces shall be mounted to the panel door for easy access.

4. Split system to be controlled by manufacturer wall mounted, hard wired controller.

5. The split system and the electric unit heater shall be off and locked out when the station operates on generator power.

6. Setpoints for operation:

a. Split Heat Pump, heating setpoint: minimum allowed by manufacturer. Provide minimum allowed setpoint information with submittal.

b. Split Heat Pump, cooling setpoint: 80°F

c. Electric unit heater setpoint: 55°F.

7. Generator controls:

a. Overview: The generator is served by an intake louver and damper, an exhaust louver, two control dampers serving generator exhaust, one exhaust control damper serving generator heat recirculation for space heating. Tie HVAC control system to the generator control panel to receive a generator run signal.

b. The intake and exhaust dampers shall operate as follows,

1) Intake damper: Parallel blade, spring open, power closed.

2) First Exhaust damper: Parallel blade, spring open, power closed.

3) Second Exhaust control damper: Opposed blade, spring open, power closed.

4) Bypass heating damper: Opposed blade, power open, spring closed.

5) All dampers shall fully open in < 20 seconds.

c. When HVAC control system detects a generator run signal, intake damper and both engine exhaust dampers will fully open. Bypass heating damper shall remain closed. Split system and electric unit heater will be locked out.

1) Provide visual alarm for failure of generator intake or exhaust dampers.

d. Room temperature control loop (refer to section in drawing H-101):

1) If space temperature drops below 55°F, bypass damper modulates open as exhaust damper one modulates closed to force re-circulation of hot exhaust air and maintain 60°F room temperature when engine is running.

2) Provide simultaneous modulation of bypass damper and second generator exhaust damper. Modulation to occur in incremental steps to maintain space temperature.

e. Generator intake and exhaust dampers shall remain open after generator stops for at least 2 minutes.

D. Generator combustion Exhaust:

1. Materials:

a. 2" and larger – Schedule 40 Carbon Steel, Welded.

b. Steel Pipe - ASTM A 53, seamless, black steel pipe, plain ends.

2. Provide tees, elbows, reducers, increasers, plate supports, rings, drain section, ceramic joint sealant and all other required accessories for a complete installation.

3. Install thimble, muffler and flex connector provided by generator manufacturer.

4. Parts exposed to weather shall be protected with one base coat and one finish coat of heat resistant paint. Paint shall be furnished and applied by installer. Coordinate with flue manufacturer for acceptable coatings.

5. Insulation:

a. Calcium Silicate Equipment Insulation – ASTM C 533, Type I, Block 3½ inches thick.

b. Jacketing Material: Aluminum jacket secured with aluminum straps.

c. Equipment Insulation Compounds – Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

2.17 SURFACE PREPARATION AND PAINTING

A. The at-grade floor slab shall receive one (1) coat of Thoroseal concrete sealer.

B. The door and frame shall be prime and finish painted in accordance with Section 09900 – Painting and Division 8.

PART 3 EXECUTION

3.1 MANUFACTURER'S RESPONSIBILITIES

A. Support Literature

1. The manufacturer of the building shall be responsible for delivery to the Engineer of four copies of the support literature required herein.

B. Installation Instructions

1. Installation of the building and related appurtenances shall be performed in accordance with written instructions by the manufacturer.

C. Operation and Maintenance Instructions

1. The building manufacturer shall be responsible for supplying written instructions, in three-ring binders, which shall be sufficiently comprehensive to enable the operator to operate and maintain the building and all equipment supplied by the manufacturer.

2. The instructions shall be prepared as a system manual applicable solely to the building and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.

3. The instructions shall include the following:

a. Descriptions of, and operating instructions for, each major component of the building as supplied.

b. Instructions for operation of the building in all intended modes of operation.

c. Instruction for all adjustments which must be performed at initial startup of the building and adjustments which must be performed in the course of preventative maintenance as specified by the manufacturer.

d. Electrical schematic diagram of the building as supplied. Wire numbers shall be shown on the schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of overall schematic diagram.

e. Layout drawing of the building as supplied, prepared in accordance with good commercial practice.

4. Operation and maintenance instructions which are limited to a collection of component manufacturer literature without overall building instructions shall not be acceptable.

5. Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these Specifications. Instruction manuals applicable

to many different configurations, and which require the operator to selectively read portions of the instructions shall not be acceptable.

3.2 OFF-LOADING AND INSTALLATION

A. The building shall be off-loaded by the Building Manufacturer in accordance with the manufacturer's recommendations with assistance from the Contractor. Contractor to provide crane with operator as required by the Building Manufacturer, from which the Building Manufacturer's rigging will hang.

B. Install structures as indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that they comply with requirements and serve intended purposes.

C. Place precast concrete sections as indicated.

D. Install rubber joint gasket, complying with ASTM C 1085-91, at joints between sections.

E. Apply bituminous mastic coating at joints between sections.

3.3 TEST AND INITIAL OPERATION

A. Factory Operational Test

1. The entire building package electrical and HVAC systems shall be factory tested by the Factory Quality Assurance personnel for conformance to the Specifications and the Operational Requirements of the building package. The fans, louvers, and heater provided by the precast building manufacturer shall be given an operational test prior to shipping. The Contractor shall verify that all building components have been installed in accordance to applicable building and electrical codes.

B. Initial Operation

1. The manufacturer shall provide the services of a factory trained representative for a minimum period of one day to provide initial start-up and testing of the building and to instruct the owner's operating personnel in the operation and maintenance of the equipment provided by them.

3.4 MANUFACTURER'S WARRANTY

A. Final acceptance of all equipment furnished under these Specifications will be withheld until after the installation and satisfactory field testing.

B. The building manufacturer shall warrant the building and its contents to be of quality construction, free from defects in material and workmanship for one year from the date of installation.

C. The precast concrete structure shall endure and not deteriorate for a period of twenty-five (25) years.

END OF SECTION

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SECTION 13201

FUEL STORAGE EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES

1. General
2. Aboveground storage tank
3. Venting
4. Tank Signage

1.2 REFERENCES

A. National Fire Protection Association (NFPA) Standard 30 – Flammable and Combustible Liquids Code

B. NFPA 31 – Installation of Oil Burning Equipment

C. NFPA 704 – Standard System for the Identification of the Hazards of Materials for Emergency Response

D. Petroleum Equipment Institute (PEI) Recommended Practice (RP) 200 – Installation of Aboveground Storage Systems

E. Underwriters Laboratories, Inc. (UL) Standard 142 – Steel Aboveground Tanks for Flammable and Combustible Liquids

F. UL Standard 2085 – Protected Aboveground Tanks for Flammable and Combustible Liquids

G. UL Standard 2085 and UFC Test Standard (Article 79 or APPENDIX #A-II-F-1), for both Vehicle Impact Protection and Projectile Resistance

H. UL Standard 2085 – Non-Metallic Secondary Containment protected tanks for flammable and combustible liquids with secondary containment Emergency Venting by "Form of Construction"

1.3 SUBMITTALS

A. Submit to the Engineer:

1. Product certificates provided by the manufacturer certifying equipment compliance with the speciation for all equipment to be provided.
2. Factory test reports
3. Warranty information

1.4 QUALITY ASSURANCE

A. Equipment manufacturers shall have a minimum of ten years of experience in the design and manufacture of equipment of similar size, type, and capacity.

B. Contractor and shall have a minimum of ten years of experience in the installation of equipment of similar size, type, and capacity and complete five projects of similar scope within the past two years.

C. High Explosive (HE) Blast Resistance: The tank system design shall be the subject of a Blast Effects Analysis (BEA) for resistance under the following blast threat load scenarios:

1. A 50-pound HE man-portable improvised explosive device (MPIED) at the standoff distance of 5 feet;

2. A 500-pound HE vehicle-born improvised explosive device (VBIED) at the standoff distance of 20 feet; and

3. A vapor cloud explosion (VCE) with a load of 10 psi.

4. The BEA shall conclude that the tank system shall resist the explosion loads and remain intact, without failure of the primary tank. The engineering consultants performing the BEA shall be a nationally recognized firm with over 10 years' experience offering comprehensive services related to blast and impact effects analysis, explosive safety design, vulnerability assessments and threat mitigation.

D. The storage tank manufacturer shall provide a written 30-year limited warranty.

PART 2 PRODUCTS

2.1 GENERAL

A. This specification has been prepared for the procurement of one aboveground storage tank. In addition to the storage tank the manufacturer shall furnish one concrete pad as shown on the project drawings.

2.2 ABOVEGROUND STORAGE TANK

A. Provide one (1) 500-gallon UL 2085 thermally insulated double-walled, horizontal tank as specified below:

1. The primary steel tank shall be rectangular in shape and have continuous welds on all exterior seams, manufactured in accordance with UL listing requirements and UL Standard 142.

2. The primary steel tank shall be pressure tested at 5 psig for 24 to 48 hours.

3. The primary steel tanks shall be vented per NFPA 30 Code requirements.

4. The protected and insulated AST systems shall have a thru-tank leak detector tube to allow for physical checkup and monitoring capability between the primary and the secondary containment.

5. The primary steel tank shall be pressurized at 5 psig during concrete encasement.

6. The outer surface of the primary steel tank shall be covered by a minimum of 1/4" thick (6.4 mm) Styrofoam insulation panels.

7. The secondary containment shall consist of a 30 Mil thick (0.76 mm) High-Density Polyethylene membrane enclosing the steel tank and insulation material.

8. The primary steel tank and the secondary containment shall be encased in six inches of monolithic reinforced concrete, with minimum design strength of 4,000 psi at 28 days. The concrete design shall include the following for long-term durability: air entrainment, water reducing admixture, and steel reinforcement. Concrete encasements with seams will not be approved.

9. The protected and insulated AST systems shall be of concrete exterior and a continuous and visually verifiable monolithic (seamless) pour on top, bottom, ends, and sides and contain no cold joints or heat sinks (heat transfer points). The AST must be shop fabricated and tested in accordance with the UL listings.

10. No steel or insulating material shall come in contact with the concrete or other corrosive material.

11. All openings shall be from the top only.

12. All exposed metal with the exception of stainless steel must be powder coated to inhibit corrosion.

13. The protected and insulated AST system shall include a minimum 5-gallon powder coated, UL listed spill containment, and shall include normally closed valve to release spilled product into the primary steel tank. Spill containment which routes the spilled product into interstitial area will not be approved.

14. The protected and insulated AST systems shall have a coated concrete exterior to resist weather and reflect sunlight. Models with steel exteriors will not be approved.

15. The protected and insulated AST systems shall have a warranty of 30 years.

16. The protected and insulated AST systems design shall have been in use for a minimum of twenty (20) years. The manufacturer must stipulate no reportable AST containment system failure in 30,000 units produced.

17. The protected and insulated AST systems shall have two (2) bolts for connecting grounding conductors for lightning protection in accordance with NFPA 780.

18. A fitting schedule is provided on the Drawings showing the fitting sizes, location and total number of required fittings.

19. A tank chart showing the conversion from inches-to-gallons in 1/8-inch increments shall be provided.

2.3 VENT

A. Primary vent confirmed by the manufacturer

1. Primary vent shall terminate no less than 12’ above finished grade.

B. Emergency vents size shall be confirmed by the tank manufacturer.

1. One threaded emergency vent shall be provided for the primary and secondary tanks.

2.4 SIGNAGE

A. Provide the following signage on all four (4) sides of the tank:

1. A 10-inch by 10-inch NFPA diamond indicating the hazards associated with the heating oil following the guidance provided in NFPA 704.

2. "500-GALLONS"

3. "NO SMOKING"

4. "COMBUSTIBLE"

B. Lettering shall be 3-inches high with black lettering on a white background.

PART 3 EXECUTION

3.1 GENERAL

A. Furnish all labor, materials, equipment and supervisory, operating and monitoring personnel to conduct the Work as specified herein in a safe and professional manner.

B. Provide warranty information for the storage tank and appurtenances.

END OF SECTION

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SECTION 13420

INSTRUMENTATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Installation and start-up of instrumentation provided under this section.

2. Equipment specified under this section shall be provided as part of the submersible pumps package, that makes up the complete turn-key package specified (Specification 11312). Coordinate with the Pump Supplier, the Integrator, and the Precast Structure Manufacturer to provide a fully functioning submersible pumping facility.

B. Related Sections

1. Section 03485 – Precast Concrete Structures

2. Section 11000 – Equipment – General

3. Section 11312 – Packaged Submersible Wastewater Pumping Equipment

4. Refer to Division 16, Electrical for wiring standards and practices.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications - Firms regularly engaged in the manufacture of instrumentation systems (the "System Supplier"), whose products have functioned satisfactorily in similar service, and has demonstrated proficiency and extensive experience with current technology.

B. Installer's Qualifications - Firms regularly engaged in the installation, calibration, and adjustment of instrumentation systems, with a minimum of five years of experience, whose systems have functioned satisfactorily in similar service and have demonstrated proficiency and extensive experience with current technology.

1.3 SUBMITTALS

A. Provide complete equipment specifications, details of connections, wiring, range and dimensions. Submittals consisting of only general sales literature will not be acceptable. Shop drawings shall be bound in separate three ring binders with an index and section, sub-section, etc., dividers. The dividers shall be arranged so its individual tabs can locate each item being referenced.

B. Submit detailed information for each instrument or control device, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

1. Product (item) name used herein and Tag number as shown on the Contract Drawings.

2. Manufacturers complete model number.

3. Location of the device.

4. Input - output characteristics.

5. Range, size, and graduations.

6. Physical size with dimensions, enclosure NEMA classification and mounting details.

7. Materials of construction of all components.

8. Calibration sheet verifying the instrument is working properly over the complete range.

C. Exceptions to the Specifications or Drawings shall be clearly defined by the System Supplier. Data shall contain sufficient details so the Engineer may make a proper evaluation.

1.4 PRODUCT HANDLING

A. Identification

1. Each component shall be tagged per the users standard numbering system or as defined herein and in the contract drawings. To identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. A permanent stainless steel tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this section. In the case where any supplied instrument is too small or of such a material as to make a stainless steel tag impossible to attach, a method of indelible marking, demonstrating the intent of this paragraph shall be submitted to the engineer for approval.

B. Storage

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment and shall be adequately protected against mechanical injury. If any apparatus has been damaged, the System Supplier at his own cost and expense shall repair such damage. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the System Supplier, or the System Supplier at his own expense shall replace the apparatus.

1.5 INSTRUMENTATION GENERAL

A. Type

1. Instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals that are established standards for the water and wastewater industries.

2. Electronic instrumentation shall be of the solid-state type. Analog control signals shall be linear and be industry standard currents of 4 to 20 mA DC (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current), or the like. No zero based signals shall be allowed.

3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standards signals for remote transmission. No zero-based signals shall be allowed.

4. Instruments shall be provided with stainless steel mounting hardware and/or galvanized steel floor stands, wall brackets, or instrument racks as appropriate for each location.

5. Equipment installed in a hazardous area shall meet Class, Group, and Division as shown on the Contract Electrical Drawings, to comply with the National Electrical Code.

6. Indicators and recorder readouts shall be linear in the process units.

7. Transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to ±2 percent.

8. Electronic equipment shall be of the manufacturer's latest design. Circuit boards and associated components shall have suitable conformal coating to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose to assure optimum long-term performance and dependability over normally anticipated atmospheric conditions of temperature, pressure and humidity. The field-mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

9. Equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

1.6 ELECTRICAL

A. Equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 110 volts, plus or minus 10 percent except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

B. Analog transmitter and controller outputs shall be 4-20 milliamps into a minimum load range of 0-750 ohms, unless specifically noted otherwise.

C. Switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA unless specifically noted otherwise.

D. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

E. Equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation upon manual resetting when power is restored.

1.7 LIGHTNING/SURGE PROTECTION

A. General - Lightning/surge protection shall be provided to protect the system from inducted surges propagating along the signal and power supply lines. The protection

systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance-free and self-restoring. Instruments shall be housed in a suitable metallic case, properly grounded. Ground wires for all surge protectors shall be connected to a good earth ground, and where practical each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure or a separate NEMA 4X junction box coupled to the enclosure. The units shall be as manufactured by EDCO, MCG Electronics, MTL Electronics, Or equal.

1. Power Supply - Protection of all instrument power supply lines shall be provided. Cabinet(s)/Panel(s) and groups of field instruments, as approved by the Engineer shall be protected by isolation transformers and surge suppressors. Individual gas-tube surge suppressors shall protect individual field instruments.

2. Signal/Communication Line - Protection of all Signal lines shall be provided. Protection devices shall be installed at both ends and as close to the equipment being protected as possible. Protection devices shall provide the equipment manufacturer's recommended protection levels but shall not interfere with communication. The protection devices shall be standard devices listed by the protection device manufacturer as suitable for the specific type of communication line.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Level Transducer and Floats to be provided by CSI of Jackson, MI as described in Section 11312.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The location of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of process control work and in case of any interference with other work, proceed as requested by the Engineer. Furnish all labor and materials necessary to complete the work in an approved manner.

B. The System Supplier shall make all necessary mechanical changes to install new instrumentation equipment provided under this Contract. This work includes all fittings, fabrications, supports, guides, restraints, bolting, gaskets, and accessories. All work shall be done in a workmanlike manner.

C. The instrumentation drawings indicate the intent of the interconnections between the individual instruments. Any exceptions should be noted.

D. Work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances, and regulations, the System Supplier shall bear full responsibility for such violations and assume all costs arising there from.

E. Equipment used in areas designated as hazardous shall be designed for the Class, Group and Division as required on the Electrical Drawings for the locations. All installations shall be in strict accordance with codes.

F. Instrument cabinets located outdoors or in unheated locations shall be provided with heating and/or cooling devices as necessary to maintain all instruments and or electronics installed in those cabinets within their design temperature limits.

G. Brackets and hangers required for equipment mounting shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The System Supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the System Supplier shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The System Supplier shall also investigate and make any field modifications to the allocated space for each cabinet, enclosure, and panel to ensure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment, but in no case shall more than one ground point be employed for each shield.

J. Lifting rings from cabinets/assemblies shall be removed. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The System Supplier shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation.

3.2 SYSTEM TESTS AND ACCEPTANCE

A. After the equipment has been delivered and installed at the site, a field acceptance test shall be performed to verify the integrity of the system. The Engineer shall witness the test. Satisfactory completion of the test, as approved in writing by the Engineer, shall constitute conditional approval of the system. The system must operate without failure for a period of 100 hours before this test will be considered successful, and the system fully accepted.

B. Before this test is started, the System Supplier shall satisfy himself that the system is operating correctly with live plant data.

C. Any malfunctions during the test shall be analyzed and corrections made by the System Supplier. The Owner's Project Representative will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

3.3 FIELD TESTS

A. The System Supplier shall furnish the services of the Manufacturer's servicemen, all special tools, calibration equipment and labor to perform the tests. Certified copies of the tests shall be furnished in duplicate to the Engineer.

B. Following connection, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, a performance check shall be made on each. Analog inputs shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, as required. All status and alarm switches as well as all monitoring and control functions shall also be checked. Each device on the Electrical Schematic\Logic Diagrams must be signed-off by the Engineer as being acceptable.

C. If, during running of the tests, one or more points appear to be out by more than the specified amount, the Manufacturer's servicemen shall make such adjustments or alternations as are necessary to bring equipment up to specification performance. Following such adjustments, the tests shall be repeated for all specified points to ensure compliance.

3.4 INSTRUCTION - STAFF TRAINING

A. All plant personnel will need training on the instrument systems. The System Supplier shall be responsible for providing detailed Operation and Maintenance (O&M) Manuals. The O&M Manuals shall include specific details of equipment supplied and details of operations specified to this project. The training will be conducted at the facilities.

B. The O&M Manuals shall include descriptions of all equipment, the nature and intended modes of operation, testing procedures of all units in the System, and safety measures to be taken in operation. All necessary procedures and methods for effective operation of the System shall be included.

C. O&M Manuals shall include record drawings and instructions necessary for the planned maintenance of all equipment in the system. The O&M Manuals will incorporate maintenance procedures and schedules, and they will coordinate and be cross-referenced to detailed operation procedures provided by the manufacturers.

D. The system training shall be structured such that the operating personnel will understand the system's operation, and the functions available in the system. The amount of training will be a minimum of 2 separate 4 hour days, scheduled as convenient for the Owner. Preventive and corrective maintenance of hardware shall be presented.

PART 4 SYSTEM DETAILS

4.1 SYSTEM DETAILS

A. Unless specifically stated otherwise, the System Supplier shall be responsible for providing all instrumentation, control equipment and auxiliary devices necessary to perform the functions specified herein and as shown and described on the contract drawings.

B. Any auxiliary devices such as lightning/surge protectors, relays, times, signal isolators, signal boosters, etc., which are necessary for complete operation of the system, or to perform the functions specified, shall be included, whether or not they are specifically shown or tabulated on the diagrams.

END OF SECTION

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SECTION 14610

PORTABLE HOISTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. One (1) 1000-pound portable davit crane

B. Related Sections

1. Section 09900 – Painting

2. Section 11000 – Equipment – General

1.2 REFERENCES

A. The State of Connecticut Building Code, most recent edition.

B. AGMA Standards.

C. American National Standards Institute – ANSI/ASME B30.10.

D. ANSI/ASME B30.11.

E. ANSI/ASME B30.16.

F. ANSI MH 27.1.

G. ANSI MH 27.2.

H. ANSI/ASME HST-4M

I. Occupational Safety and Health Administration – OSHA Specification 1910.179.

J. NEMA Standards.

1.3 SUBMITTALS

A. Submit shop drawings showing complete dimensions of portable davit crane and pedestal base plate system.

B. Submit catalog cuts fully illustrating and describing portable davit. Mark out non-applicable information.

C. Submit data sheets indicating materials of construction and reference standard for same.

D. Submit manufacturer's recommended base mount installation methods and required hardware. Submit loads imposed on the davit crane base.

E. A marked-up version of this specification, which clearly indicates compliance with the provisions of this specification as well as any exceptions or deviations from the requirements of this specification. Contractor shall carefully review each paragraph and mark it with either a check indicating the submittal is in compliance with the requirements, or an "X" if the requirement cannot be met. For any paragraph marked

with an "X", include a description of why the requirement is not applicable or a description of any deviations from the requirements.

F. Submit manufacturer's installation instructions.

G. Submit manufacturer's affidavit (Certificate of Conformance) stating that material or product complies with the reference standards.

1.4 DELIVERY, STORAGE AND HANDLING

A. The manufacturer shall match-mark all mechanical connections before dismantling the equipment for shipment to the site.

1.5 WARRANTY

A. The manufacturer shall provide a one-year warranty of all furnished equipment.

1.6 FIELD MEASUREMENTS

A. Verify dimensions in the field before fabrication for items requiring field measurements.

PART 2 PRODUCTS

2.1 GENERAL

A. Equipment under this Section shall be of the highest quality and amply proportioned for safe and reliable service. Workmanship shall be of the highest grade in all aspects.

B. Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

C. All materials shall be properly selected for the stresses to which they will be subjected. Design stresses and safety factors shall be in accordance with ANSI MH 27.1 Specifications.

D. All welding performed on the crane should conform to the current recommended practices of the AWS (American Welding Society) D14.1.

E. All welding performed on the crane shall be performed by a qualified welder.

F. The davit shall be capable of operation in excessive moisture and corrosive environment with a design factor greater than 2.6:1 for all components including the lifting winch and base.

G. The davit crane shall be labeled with a non-corrosive metal identification plate imprinted with the manufacturer’s name, model number, serial number and capacity rating.

2.2 MANUFACTURER:

A. Thern Inc., Winona, MN

B. Halliday Products, Orlando, FL

C. or equal.

2.3 1000- POUND PORTABLE DAVIT CRANE

A. The portable davit cranes shall have an adjustable boom ranging from 23 to 66 inches in length and shall have the ability to reach a hook height of at least 6 feet. The davit crane boom shall be adjustable in height.

B. The portable davit crane shall have a drill-drivable hand winch equipped with worm gears and have a brake system for load control.

C. The portable davit crane shall have a drill-drive kit with drill-motor to power drive the worm gear hand winch.

D. The portable davit crane shall rotate 360 degrees in all base mounts.

E. The portable davit crane shall be rated to lift 1,000 pounds in all base mounts.

F. The portable davit crane shall be equipped with 1/4" stainless steel lifting cable of an adequate length to lift objects at least 30 feet below the crane base.

G. A 1-ton galvanized hook shall be supplied.

H. The portable davit crane shall have a lifting height of at least 72” above the base mount.

I. The portable davit crane shall have a max weight of 175 pounds.

J. The portable davit crane and all hardware shall be 304 stainless steel.

2.4 1000- POUND PORTABLE DAVIT CRANE BASE MOUNTS

A. One davit crane base mount shall be supplied and installed in the location shown on the Drawings. Coordinate the type of base mounts with the installation requirements at each of the base mount locations.

B. Base mounts and all mounting hardware shall be entirely 304 stainless steel.

C. Caps or covers shall be provided with each mount to prevent water from entering the base mount when it is not in use. Caps shall be provided with chain or wire and attached to base to prevent loss.

2.5 FINISH

A. All crane components including the base mounts and electric winches shall be finished per the manufacturer’s standard corrosion resistant enamel finish.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions and as indicated.

B. All parts and equipment at the site shall be protected from weather, damage, abuse, and loss of identification. The installation procedures shall insure that the equipment is installed without initial stresses, forced or improvised fits, misalignments, nicks of high strength structural steel components, stress-raising welds, and rough burrs. After the equipment is installed, any damaged painted surfaces shall be cleaned and repainted.

3.2 FIELD TESTS

A. Conduct field tests with the equipment in its installed position. Tests shall include a load test in compliance with OSHA requirements and demonstration to the Engineer that under this load condition the equipment will perform satisfactorily throughout the complete load range and range of motion.

3.3 LUBRICATION

A. The equipment shall be provided with all necessary lubrication fittings and lubrication. Before initial start-up at final installation, all bearings, gears, etc. shall be lubricated in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 15050

PIPING - GENERAL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Permit requirements and documentation
2. Sleeves and seals for all wall, floor and roof penetrations
3. Escutcheons
4. Wall Pipes
5. Anchor bolts
6. Pipe and equipment coatings
7. Piping installation
8. Testing
9. Cleaning
10. Pressure testing

B. Related Sections

1. Section 09900 - Painting
2. Section 15060 - Hangers and Supports
3. Section 15075 - Mechanical Identification
4. Yard piping for process piping, utility services, sanitary, storm, and roof drainage systems outside the building is included in Division 2.

1.2 REFERENCES

A. ASTM A778 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

B. ASTM A36 – Specification for Carbon Structural Steel

C. American Water Works Association, AWWA C651, AWWA Standard for Disinfecting Water Mains

D. Connecticut State Plumbing Code – Section 610 Disinfection of Potable Water Systems

1.3 SUBMITTALS

A. Material specifications and shop drawings for all materials and equipment furnished under this Section

B. Layout drawing for hangers and supports

C. Certificates of Compliance on all pipe materials

D. Pipeline testing and disinfection procedures

1.4 QUALITY ASSURANCE

A. The location of all equipment, fixtures, and piping is considered to be approximate only and the Engineer has the right to change at any time before the work is installed, the position of equipment and piping to meet structural conditions, avoid interferences, provide proper clearances or for other sufficient causes. Such changes shall be made without additional expense to the Owner.

B. Secure all permits and pay all fees required to carry out the piping work. Comply with all laws, ordinances, codes, rules, and regulations of the local and state authorities having jurisdiction over any of the work specified herein. Where provisions of the Contract are in conflict with the codes, the more stringent of either the codes or the Contract Documents shall govern.

C. The drawings and diagrammatics show the pipe sizes and general routing. Offsets and fittings required to avoid field interferences and provide improved layout shall be provided at no additional cost to the Owner.

D. All pipe, tube, hose, and fittings in a given specification section shall be the product of a single manufacturer who is experienced in the manufacture of the materials to be furnished. The manufacturer must have provided materials which have be successfully installed and operated for at least 5 years in a similar application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installing, and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired as directed by the Engineer at no additional cost to the Owner.

B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before installing, shall be kept clean until they are used in the work, and when installed shall conform to the lines, grades and dimensions required.

C. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials used for public water systems or plumbing system providing water for human consumption shall be lead free as defined by the Reduction of Lead in Drinking Water Act.

B. Sleeves and Seals - Furnish all sleeves required under this Division. Coordinate the sleeve locations and elevations for placement.

1. Sleeves will be required at the locations shown on the Drawings or as specified herein. The type of wall penetration shown on the Drawings shall govern over the summary presented herein.

2. Sleeves shall be Schedule 5S stainless steel in accordance with ASTM A-778 with seep rings. Seep rings shall be welded continuous, placed on the center of the sleeve and project 3 inches. Floor sleeves shall be 3 inches longer than the floor slab depth and shall project 3 inches above finish floor level for housekeeping purposes. Wall sleeves shall be the same length as the wall thickness. Sleeves passing through partition walls do not require seep rings.

3. Sleeves for carrier pipes 1 inch diameter and less shall be Type WSK as manufactured by O.Z. Electrical Manufacturing Company, Brooklyn, NY, Wall-Seal by Dresser Manufacturing, GPT/Thunderline, or equal.

4. HVAC Sleeves:

   a. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

   b. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

   c. Sleeves for Round Ductwork: Galvanized steel.

   d. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

   e. Sealant: Acrylic.

5. Sleeves with seals as described hereinafter shall be used for all carrier pipes larger than 1 inch in diameter. Seals between steel sleeve and carrier pipe shall be made using "Linkseal" as manufactured by GPT/Thunderline Corporation, Pen-Seal as manufactured by Proco Products, Innerlynx or equal. Sizing of sleeves, selection of link model numbers and sizes shall be in strict accordance with the manufacturer's instructions to ensure watertightness.

   a. Same environment on both sides of wall or floor - sleeves are required. No seal between the pipe and sleeve is required in these locations.

   b. Pipes passing through foundation walls with soil on both sides - pipes shall pass through an oversized opening. Sleeves with seals are not required at these locations.

   c. Sanitary soil pipes, floor drain pipes, and roof drain pipes passing through walls and floors between areas of different environments - water stopped sleeves shall be used and sealed as described above.

6. Pipes penetrating a concrete floor poured on soil above grade shall be poured in place. Pipes shall be fully isolated with full depth, ¼ inch thick, self-expanding cork or other bond-breaking material held securely in place during concrete placement. The annular space at finish floor shall be caulked.

C. Escutcheons - Where uncovered pipe passes through finished walls or ceilings, a chrome plated escutcheon shall be provided.

D. Wall Pipes - Wall pipes shall be provided where called for on the Drawings. Wall pipes shall be provided with a 3 inch high seep ring welded continuous and placed on the center of the pipe. Seep ring shall be ASTM A36 steel, minimum ¼ inch thick. Wall pipe interior shall be finished equal to main line with end connections as required (MJ, Flanged, PE, Push-on Bell).

E. Anchor Bolts - Anchor bolts, nuts, washers, and bolt sleeves shall be Type 316 stainless steel. Expansion bolts shall be "Thunderstuds," as manufactured by Unifast Industries, Inc., Hauppauge, NY, Redhead "Wedge Anchors" as manufactured by ITT Phillips; Michigan City, Indiana or Molly parabolt as manufactured by USM Corporation, Shelton, CT. All expansion bolts and associated hardware shall be stainless steel.

2.2 FINISHES

A. Pipe and Equipment Coatings - The prime and field applied coatings shall conform to the requirements of Section 09900. Prime coats must be compatible with the paint system approved for this project.

1. Exposed piping shall be painted in accordance with the individual pipe specification section and Section 09900.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean and prepare pipe joints to be free of scale, dirt, and debris prior to connections.

B. Comply with the surface preparation requirements outlined in Section 09900 for all piping, supports and hangers.

3.2 INSTALLATION

A. Work shall be installed in accordance with the manufacturer's printed instructions and shall be plumb and true to line. Install piping as close to walls, and ceilings as possible yet facilitating maintenance and access to valves and devices. In general, piping systems shall parallel walls, partitions, and structural members. Offsets and fittings to accomplish a neat and workmanlike installation shall be provided at no additional cost to the Owner. Piping shall be installed true to the grades required as shown on the Drawings.

B. Take care that stresses are not imposed on the pipe during installation.

C. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and joint method and their locations shall be verified from approved piping layout drawings and the structural drawings. Layouts for hanger and supports shall be submitted to the Engineer for approval. Pipe hangers and supports shall conform to the requirements of Section 15060.

D. All valves, fittings, and appurtenances needed on the pipelines shall be set and jointed as indicated on the Drawings or as required.

E. Equipment Connections - Provide unions and control valves on services to equipment provided under other Sections. All valves are to be installed in the upright position. Valves shall be installed and located so they can be operated easily and shall be located adjacent to the equipment.

F. Unions - All piping 2 inches and smaller shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer.

G. Cutting and Patching - Sleeves not initially set in the work shall be cut in place with permission of the Engineer. This work shall be performed by workmen competent to do the work and equipped with proper hand tools. Power tools with the exception of core boring machines shall not be used.

H. Welding - Welding shall only be performed by certified welders tested in the position applicable to the work. Welding shall be performed in accordance with AWS standards. Copies of welding certifications shall be provided to the Engineer.

I. Pipe identification and marking shall be in accordance with Section 15075.

3.3 REPAIR/RESTORATION

A. During the course of the Work, protect all materials, fixtures, and equipment from damage. Any damage to piping, linings or coatings shall be repaired to the satisfaction of the Engineer or replaced.

3.4 CLEANING

A. At the completion of the Work, thoroughly clean all piping and equipment installed. Remove all concrete, stickers, rust stains, foreign matter and discoloration. Piping and equipment shall be in a thoroughly clean condition and ready for finish painting.

B. All potable water piping shall be thoroughly flushed and disinfected prior to placing in service in a manner approved by the Engineer.

3.5 PRESSURE TESTING

A. Testing - Test all piping systems in accordance with the piping section requirements or to the code applicable to the location where the work is performed. Pipes shall hold pressure without the addition of water or additional pumping. Additional tests or methods may be required by local ordinances or inspection authorities. Tests shall be repeated as necessary to make the systems tight and accepted. Provide all water, air, or gas, apparatus, gauges, and materials necessary for performing tests.

B. Provide all equipment, materials, and apparatus to conduct pressure tests as required by code or the individual piping sections. All tests shall be witnessed by the Engineer. Any leaks shall be repaired and the pipe retested to the Engineer's satisfaction.

C. Test pressure and duration shall be as specified in the individual piping sections.

END OF SECTION

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SECTION 15060

HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Manufactured piping hangers and supports

2. Miscellaneous materials

B. Related Sections

1. Section 15050 - Piping - General

1.2 REFERENCES

A. Manufacturers' Standardization Society SP-58, Pipe Hangers and Supports - Materials Design and Manufacture, Selection and Application, Fabrication and Installation Practices

B. Manufacturers' Standardization Society SP-90, Guidelines on Terminology for Pipe Hangers and Supports

C. ASTM A 36 - Specification for Structural Steel

D. ASTM A 123 –Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

E. ASTM A 780 - Practice for Repair of Damaged Hot Dipped Galvanized Coatings

F. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

G. ASME B 31.9 - Building Services Piping

H. American Welding Society (AWS) Structural Welding Code

1.3 DESIGN REQUIREMENTS

A. Mechanical components and systems and their attachments shall be designed in accordance with ASCE 7-05, Section 13.6 Mechanical and Electrical Components, the International Building Code (IBC 2021), and Section 1621 of IBC 2021, Connecticut State Building Code and Supplements.

B. The design of each pipe support and pipe support framework shall be the responsibility of the Contractor. Shop drawings, as specified below, shall be submitted and shall show all details of the installation, including dimensions and types of support. In all instances, the completed frame shall be adequately braced to provide a complete rigid structure when all piping has been attached.

C. Shop Drawings for hangers, supports, mechanical attachments, and for all associated structural steel framework shall be stamped by a Professional Engineer registered in the State of Connecticut.

1.4 SUBMITTALS

A. Product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements and complies with Manufacturers' Standardization Society Standards.

C. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

D. Assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

1.5 QUALITY ASSURANCE

A. Provide anchors and supports in conformance with the Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. (MSS). All materials, design, manufacture, selection, application and fabrication shall be in conformance with the appropriate MSS numbers.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code-Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has underground re-certification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete Pipe Supports - All process piping shall be provided with concrete pipe supports wherever feasible. Supports shall be a minimum 10 inches thick from finished floor to the centerline of pipe. Concrete shall be secured to floor using drilled-in anchors at all four corners. Concrete shall be provided with ¾ inch chamfer on all edges and a rubbed finish in accordance with Section 03300. Provide a plastic sheet between concrete support and piping. Pipe shall be socket clamped and anchored to the concrete support. Socket clamp shall be stainless steel for stainless steel pipe and hot-dipped galvanized for D.I. pipe. Anchor bolts shall be stainless steel.

B. Manufactured Piping Hangers and Supports - Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.

1. Components shall be stainless steel where installed for stainless steel piping. As a minimum, components to be stainless steel include clevis hangers, pipe clamps, pipe supports, plate bases, pipe saddles, U-bolts, floor stanchions, threaded rod with nuts, rod couplings, brackets and all miscellaneous connecting and supporting hardware. Structural steel work required for pipe racks and trapezes shall be A-36 steel, sandblasted, primed and finish painted using the approved paint system for this project.

2. As a minimum, all components shall have hot-dipped galvanized coatings where installed for all other piping and equipment.

3. Components shall have a plastic coating where installed for piping and equipment in chemical feed areas.

4. Pipe attachments shall have plastic coating for electrolytic protection where attachments are in direct contact with copper tubing.

5. Hangers and supports with a copper coating will not be acceptable.

6. All hangers and supports shall have some form of adjustment available after installation.

7. Hanger rods shall be subjected to tension only. Lateral and axial movements shall be accommodated by proper linkage in the rod assembly.

8. Strut channel hangers shall be used to support parallel piping. Strut clamps, straps, and rollers shall be used to maintain proper alignment. Thermal expansion roller hangers shall be utilized for all heating supply and return lines. Strut channel trapeze hanger systems shall be hot-dipped galvanized after fabrication (ASTM A123). Hardware shall be electro-plated zinc (ASTM B633).

9. Floor supported process piping shall be supported by pipe supports which are provided with a base stand secured to the concrete using stainless steel anchors, adjustable shank, saddle, U-bolt, and hex nuts to hold pipe securely to the saddle.

C. Roof Pipe Stands

1. General Requirements for Pipe Stands: Manufactured assemblies made of a polymer base and corrosion-resistant components to support roof-mounted piping.

2. Low Profile Compact Roller Pipe Stand:

   a. Base: Round or square, injection molded, high density/high impact polypropylene with UV-inhibitors and antioxidants. Color black.

   b. Bolt Type: Hot dip galvanized steel [304 stainless steel].

   c. Roller: Cast iron with malleable sockets, hot dip galvanized steel finish per ASTM A 123.

   d. Hardware: Hot dip galvanized [304 stainless steel] nuts and washers.

3. Adjustable Height Roller Pipe Stand:

   a. Base: Round or square, injection molded, high density/high impact polypropylene with UV-inhibitors and antioxidants. Color black.

   b. Bolt Type: Hot dip galvanized steel [304 stainless steel].

   c. Rod: Minimum ½" diameter, 10" long, hot dip galvanized steel [304 stainless steel].

   d. Roller: Cast iron with malleable sockets, hot dip galvanized steel finish per ASTM A 123.

   e. Hardware: Hot dip galvanized [304 stainless steel] nuts and washers.

4. Channel Support:

   a. Base: Square, injection molded, high density/high impact polypropylene with UV-inhibitors and antioxidants. Color black.

   b. Bolt Type: Hot dip galvanized steel [304 stainless steel].

c. Rod: Minimum ½" diameter, 4-16" long, hot dip galvanized steel [304 stainless steel].

d. Channel: 13/16" x 12", roll-formed 3-sided tubular shape, perforated with 2" slots at 2" centers on one side, 12 gauge, hot dip galvanized [304 stainless steel].

e. Hardware: Hot dip galvanized [304 stainless steel] nuts and washers.

D. Manufactured Shelf Brackets

1. Shelf brackets shall be designed for a 1,200 pound design load.

2. Brackets shall be sized with horizontal and vertical legs approximately equal to the shelf width.

3. Construct brackets using 2½ inch by 2½ inch by ¼ inch stainless steel angle material.

E. Miscellaneous Materials

1. Steel Plates, Shapes, and Bars shall conform to ASTM A 36.

2. Cement Grout - Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

F. Pipe Alignment Guides - Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installing until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-58.

B. Install supports with maximum spacings complying with MSS SP-58.

C. Install supports with minimum rod diameter complying with MSS SP-58.

D. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-58. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2,500 psi is indicated, install reinforcing bars through openings at top of inserts.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

G. Install hangers and supports so that piping live and dead loading and stress from movement will not be transmitted to connected equipment.

H. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.

I. Insulated Piping - Comply with the following installation requirements.

1. Shields - Install protective shields MSS Type 40 on insulated components with vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in accordance with MSS SP-58.

2. Pipes 8 inch and larger shall have wood inserts.

3. Insert material shall be at least as long as the protective shield.

4. Thermal Hanger Shields - Install where indicated, with insulation of same thickness as piping.

J. Anchors

1. Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

2. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.

3. Anchor Spacings - Where not otherwise indicated, install anchors at ends of principal pipe runs. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

K. Pipe Alignment Guides

1. Install pipe alignment guides on piping that adjoins expansion joints and elsewhere as indicated.

2. Anchor to building substrate.

L. Equipment Supports

1. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.

2. Grouting - Place grout under supports for piping and equipment.

M. Shelf Bracket Supports

1. Anchor brackets into concrete wall using anchors specified in Section 15050.

3.3 CONSTRUCTION

A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding - Comply with AWS D1-1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contoured welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustment - Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 CLEANING

A. For galvanized surfaces clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Painted Identification Materials
2. Plastic Pipe Markers
3. Valve Tags
4. Plastic Equipment Markers
5. Plasticized Tags

B. Related Sections

1. Section 09900 - Painting
2. Division 15 Sections which specify pipe and valve marking and identification.

1.2 REFERENCES

A. ANSI Standards - Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.3 SUBMITTALS

A. Manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples of each color, lettering style and other graphic representation required for each identification material or system.

1.4 QUALITY ASSURANCE

A. Mechanical identification materials shall be provided by firms regularly engaged in manufacture of identification devices of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years.

1.5 MAINTENANCE

A. Extra materials

1. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
2. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide mechanical identification materials of one of the following or equal:

1. Allen Systems, Inc.

2. Brady (W.H.) Co.; Signmark Div.

3. Seton Name Plate Corp.

2.2 MATERIALS

A. Mechanical Identification Materials

1. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 15 sections. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category.

B. Painted Identification Materials

1. Provide standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4 inch high letters for ductwork and not less than ¾ inch high letters for access door signs and similar operational instructions. Provide 1 inch high letters for labeling tanks between 0-20 gallons; 2 inch high letters for tanks between 20-500 gallons; and 4 inch high letters for tanks greater than 500 gallons.

2. Utilize standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

3. Utilize standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

C. Plastic Pipe Markers

1. Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

2. Furnish 1 inch thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2 inches beyond each end of plastic pipe marker.

3. For external diameters less than 6 inch (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

4. For external diameters of 6 inch and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

a. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

5. Color coding shall apply to the background color of the identification markers. Color code all pipe markers in accordance with Section 09900.

6. Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, as selected by the Engineer in cases of variance with names as shown or specified. Custom wording shall be provided when no standard nomenclature is available.

7. Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

8. Pipe markers shall be minimum 2 inches wide.

D. Valve Tags

1. Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in ¼ inch high letters and sequenced valve numbers ½ inch high, and with 5/32 inch hole for fastener.

a. Provide 1-1/2 inch diameter tags, except as otherwise indicated.

b. Provide size and shape as specified or scheduled for each piping system.

c. Fill tag engraving with black enamel.

2. Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

3. Provide manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8-inch center hole to allow attachment.

E. Plastic Equipment Markers

1. Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code:

a. Green - Cooling equipment and components.

b. Yellow - Heating equipment and components.

c. Yellow/Green - Combination cooling and heating equipment and components.

d. Blue - Equipment and components that do not meet any of the above criteria.

e. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

2. Include the following, matching terminology on schedules as closely as possible:

a. Name and plan number.

b. Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.

3. Provide approximate 2-1/2 inch by 4 inch markers for control devices, dampers, and valves; and 4-1/2 inch by 6 inch for equipment.

F. Plasticized Tags

1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing approximately 3-1/4 inch by 5-5/8 inch, with brass grommets and wire fasteners and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

G. Lettering and Graphics

1. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

2. Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 EXECUTION

3.1 INSTALLATION

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of removable concealment, if any.

B. Piping System Identification

1. Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

a. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

2. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

a. Near each valve and control device.

b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

d. At access doors, manholes and similar access points that permit view of concealed piping.

e. Near major equipment items and other points of origination and termination.

f. Spaced intermediately at maximum spacing of 50 feet along each piping run, except reduce spacing to 25 feet in congested areas of piping and equipment.

C. Valve Identification

1. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves.

D. Mechanical Equipment Identification

1. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

a. Main control and operating valves, including safety devices and hazardous units.

b. Meters, gauges, thermometers and similar units.

c. Pumps, compressors, condensers and similar motor-driven units.

d. Fans, blowers, primary balancing dampers and mixing boxes.

e. Packaged HVAC central-station or zone-type units.

2. Where lettering larger than 1 inch height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

3. Minimum ¼ inch high lettering for name of unit where viewing distance is less than 2 feet, ½ inch high for distances up to 6 feet and proportionately larger lettering for greater distances. Provide secondary lettering of 67% to 75% of size of the principal lettering.

4. In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

5. At Installer's option, where equipment to be identified is concealed, plasticized tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).

a. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

3.2 ADJUSTING

A. Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

3.3 CLEANING

A. Clean face of identification devices.

END OF SECTION

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SECTION 15101

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Ductile Iron Pipe and Fittings

B. Related Sections

1. Section 09900 - Painting

2. Section 15050 - Piping - General

1.2 REFERENCES

A. ANSI/AWWA C151/A21.51, Standard Specification for Ductile Iron Pipe, Centrifugally Cast for Water.

B. ANSI/AWWA C150/A21.50, Standard Specification for the Thickness Design of Ductile Iron Pipe.

C. ANSI/AWWA C110/A21.10, Standard Specification for Ductile Iron and Gray Iron Fittings 2-inch through 48-inch for Water.

D. ANSI/AWWA C104/A21.4, Standard Specification for Cement-Mortar Lining for Ductile Iron Pipe and Fittings.

E. ANSI/AWWA C115/A21.15, Standard Specification for Flanged Ductile Iron Pipe with Threaded Flanges.

F. ASTM A183, Standard Specification for Carbon Steel Track Bolts and Nuts

G. ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.

H. ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

I. ASTM A449, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.

J. ASTM B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

K. ASTM C283, Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.

L. ASTM D792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

M. ASTM D2000, Standard Classification System for Rubber Products in Automotive Applications.

N. ASTM D5162, Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates.

1.3 SUBMITTALS

A. Administrative Submittals

1. Detailed description of proposed pipe handling and installation methods along with the manufacturer's approval of those methods.

2. Construction details and schedule of work for each connection to existing piping at least 7 days prior to beginning the Work. Approval must be received before commencement of Work on-site.

B. Shop Drawings

1. Manufacturer's drawings and catalog cuts, including descriptive literature indicating product characteristics and conformance with specifications and code requirements. Submit shop drawings for ductile iron pipe; fittings; couplings; filling rings; linings and coatings; and all accessories.

2. Detailed layout sheets (laying schedule) and connection details for pipe and appurtenances. Layout sheets shall consist of, but not be limited to, pipe elevations, pipe lengths, bend sizes/angles and tie-in locations.

3. Large scale details of special castings.

C. Quality Control Submittals

1. Certificates of compliance on pipe materials.

2. Prior to first shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

3. Manufacturer of pipe and Manufacturer of fittings on the project shall have an established, annually audited and certified, quality control procedure for manufacturing of pipe and manufacturing of fittings respectively. Manufacturer shall be certified by an independent, third party auditor for compliance with all requirements of the AWWA standards. The manufacturer shall submit a current certificate of compliance for the plant facility where the pipe or fittings are to be made. Certificate of compliance shall be submitted for each additional year of manufacturing during the duration of the Project. The manufacturer shall not change the plant manufacturing the pipe or fittings during the duration of the Work.

1.4 QUALITY ASSURANCE

A. Pipe and fittings shall be inspected at the foundry as required by the standard specifications to which the material is manufactured. In addition, the Owner reserves the right to have any or all pipe, fittings, and special castings inspected and/or tested by an independent service, or by the Engineer, at either the manufacturer's plant or other testing laboratory at their own expense.

B. Ductile iron pipe shall be from a single manufacturer. Fittings shall be from a single manufacturer, not necessarily the pipe manufacturer.

C. The Engineer will inspect the pipe and fittings after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements. Pipe rejected after delivery, or at any point during the progress of the Work, shall be marked for identification and shall immediately be removed from the job site and replaced at no additional cost to the Owner.

D. Test pipe under pressure for defects and leakage in accordance with Section 02502.

E. Comply with the provisions of Section 15050

1.5 PROJECT CONDITIONS

A. Secure permits and pay fees required to carry out the piping work. Comply with laws, ordinances, codes, rules, and regulations of the local and state authorities having jurisdiction over the Work. Where provisions of the Contract Documents are in conflict with the codes, the more stringent shall govern.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. American Cast Iron Pipe Company

B. U.S. Pipe

C. or equal

2.2 PIPE AND FITTINGS – GENERAL

A. Ductile iron pipe shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151. Fittings and other materials referenced in this section shall conform to the latest edition of the references listed in Paragraph 1.2 of this section.

B. Unless otherwise indicated or specified in the Contract Documents, ductile iron pipe installed above ground, shall be Class 53 with flanged joints. Grooved end pipe and couplings may be used where approved by the Engineer.

C. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be installed flush with the end of the pipe. Uni-flange type couplings are not acceptable. Flanged ductile iron pipe shall be classified by Underwriter's Lab, Inc. in accordance with ANSI A21.15 (AWWA C115).

D. Filler flanges and beveled filler flanges shall be furnished and installed as required on the Drawings or approved by the Engineer. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts. Filler flanges and/or beveled filler flanges shall be installed only where shown on the Drawings or approved by the Engineer.

E. Where approved by the Engineer, grooved end couplings may be used instead of flanges, provided that rigid grooving is used to preclude longitudinal pipe movement and angular deflection at joints. Fittings, valves, and equipment installed using grooved couplings shall be adequately supported and blocked or restrained to prevent rotation.

F. Grooved end couplings shall be manufactured in two sections of cast ductile iron conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Gaskets used for potable water applications shall be UL classified in accordance with

ANSI/NSF-61 for potable water service. Mechanical coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183, minimal tensile strength of 11,000 psi.

G. Flanged joints shall be assembled with bolts and nuts, bolt studs with nut on each end, or studs with nuts in tapped flanges. Bolts and nuts shall be manufactured in accordance with ASTM A193, Grade B8, 18-8 Stainless Steel, heavy hex head, 75,000 psi minimum tensile strength with X-Heavy nuts. Nuts and bolts shall be provided with an anti-seize, thread lubricating compound.

H. Gaskets for flanged joints shall be full face, 1/8 inch red rubber. Ring gaskets shall be provided for piping 14 inches in diameter and larger.

A. Pipe and fittings shall be cement mortar lined and seal coated on the interior in accordance with AWWA C104. Cement mortar lining shall be twice the standard thickness; tolerance shall be minus 0 inches, plus 1/8 inch.

B. Ductile iron pipe and fittings for sewage or sludge service shall be cement mortar lined with a bituminous seal on the inside in accordance with ANSI/AWWA C104/A21.4 except that the cement mortar lining shall be double the standard thickness.

C. Fittings shall be ductile iron or gray iron. Flanges and fittings shall conform to ANSI/AWWA C110/A21.10 for 250 psi minimum pressure rating. Fittings and pipe shall have standard 125 pound flanges, flat faced.

D. Sleeves and wall pipes shall be furnished and placed in accordance with the requirements of Section 15050.

2.3 COUPLINGS

A. Solid sleeves shall have long body type (12 inches min.) and mechanical joints with retainer glands.

B. Couplings and transitional couplings for pipe less than or equal to 12 inches in diameter shall consist of a long body cast iron sleeve and shall have gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant high strength, low alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Romac style 501, Dresser style 153, Rockwell type 441, or equal. Transition couplings for pipe less than or equal to 12 inches in diameter shall be Dresser Style 162, Rockwell Type 441, Smith Blair Omni Style 442, or equal.

C. Couplings and transitional couplings for pipe greater than 12 inches in diameter shall consist of a steel sleeve with gaskets suitable for the pipe being joined. The bolts and nuts shall be corrosion resistant high strength, low alloy steel such as Cor-Ten steel or an approved equal. Couplings shall be Dresser Style 38, Smith Blair Style 311, Romac Style 400, or equal. Transition couplings for pipe greater than 12 inches in diameter shall be Dresser Style 62, Smith Blair Style 413, Romac Style TC400, or equal.

Provide couplings with an exterior epoxy coating.

2.4 FINISHES

A. Provide a shop primer on exposed pipe in accordance with Section 09900. Finish painting shall be in accordance with Section 09900.

PART 3 EXECUTION

3.1 PREPARATION

A. Pipe surface preparation shall be the work of this Section and shall be performed in accordance with Section 09900.

3.2 INSTALLATION

A. Comply with the provisions of Section 15050.

B. Flanged joints shall be made with opposite bolts tightened alternately and evenly. Bolt threads shall extend no more than 2-3 threads beyond the nut after tightening.

3.3 FIELD QUALITY CONTROL

A. Comply with the provisions of Section 15050.

B. Pressure and leakage tests will be required. The test pressures for the various pipe lines shall be at least two times the operating pressure of the system or 150 psi maximum. Actual test pressures will be determined by the Engineer. Test pressure shall be maintained with no loss in pressure for a period of 4 hours minimum.

END OF SECTION

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SECTION 15125

METERS AND GAUGES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Pressure gauges and fittings

B. Related Sections

1. Section 15050 - Piping - General

1.2 SUBMITTALS

A. Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

B. Product certificates signed by manufacturers of meters and gauges certifying accuracy's under specified operating conditions and products' compliance with specific requirements.

C. Maintenance data for each type of meter and gauge for inclusion in Operation and Maintenance Manuals.

1.3 QUALITY ASSURANCE

A. UL Compliance - Comply with applicable UL standards pertaining to meters and gauges.

B. ASME and ISA Compliances - Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers - Provide products by one of the following or an approved equal:

1. Pressure Gauges and Accessories

a. Wika

b. Ametek, U.S. Gauge Div.

c. Ashcroft Dresser Industries Instrument Div.

d. Trerice (H.O.) Co.

e. Weksler Instruments

f. Or equal

2.2 PRESSURE GAUGES

A. Pressure gauges shall be provided where shown on the Drawings, specified in the detailed specifications or required for a complete installation.

B. Gauges shall be mounted on the suction and discharge of each pump where shown on the Drawings.

C. The gauge tap shall be ½ inch NPT and shall be free from burrs or other irregularities.

D. Pressure gauges shall be a 4½ inch diameter minimum, black FRP (fiberglass reinforced polypropylene) case, glycerin filled, acrylic lens, screwed lens ring, solid front, blow-out back, bronze bourdon tube, ½ inch NPT brass socket, bottom connection, stainless steel brushed movement, 1% accuracy full scale ANSI B 40.1 grade 1A.

E. Pressure range for discharge gauges shall be 0 – 100 psi. Pressure range for suction gauges shall be 15 psi vacuum to 15 psi. Pressure ranges shall be graduated in PSI, vacuum ranges in inches of mercury, pressure gauges for all pumps shall be graduated in both PSI and feet of water.

F. Pressure gauges shall be provided with an external ½ inch NPT brass snubber to reduce the pressure pulsations to the gauge and a ½ inch NPT brass shut off ball valve. All interconnecting pipe and fittings shall be brass.

G. Provide a diaphragm protection seal where indicated, to the gauge and snubber to prevent the media to be measured from clogging or corroding the bourdon tube of the pressure gauge. Diaphragm protection seal shall be of the cleanout design type which will allow cleaning of the lower diaphragm assembly chamber without loss of the fill fluid between the gauge and seal and shall not require refilling or recalibration. The upper housing shall be plated steel. The diaphragm element shall not be less than 2 inches in diameter and shall be made of solid Teflon. The lower housing shall be suitable of the service intended and shall have a ½ inch NPT process connection. Pressure gauges and snubbers that are assembled to diaphragm seals shall be filled with 50 cSt silicone fill between the gauge and seal. All gauges and seal assemblies shall be tested and calibrated to ensure proper operation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Gauges – Install gauges for piping systems at proper angle for best visibility.

B. Piping installation requirements are specified in other sections of Division 15. The drawings indicate the general arrangement of piping, fittings, and specialties.

3.2 CLEANING

A. Clean windows of meters and gauges and factory finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION

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SECTION 16050

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Basic Electrical Requirements specifically applicable to Division 16 Sections
2. As-Built Documentation

B. Related Sections

1. Section 01140 – Work Restrictions
2. Section 01770 - Closeout Procedures
3. Section 16080 - Electrical Testing

1.2 REFERENCES

A. ASCE 7-10 – Minimum Design Loads for Buildings and Other Structures

B. International Building Code – IBC 2021

C. Connecticut State Building Code

D. NFPA 70 - National Electrical Code

E. NFPA 79 – Electrical Standard for Industrial Machinery

F. ANSI/ISA-S5.4 – Instrument Loop Diagrams

1.3 SUBMITTALS

A. Submit shop drawings, product data, and reports.

B. Submit as-built documentation in accordance with Section 01770. I&C documentation shall conform to the latest versions of NFPA 79 and ANSI/ISA-S5.4.

C. Submit a written warranty.

D. Seismic restraint details including stamped certification from a professional engineer.

E. Provide a schedule of all Electrical system related Owner training, within one month of the Notice to Proceed. Prior to training, resubmit schedule if training is rescheduled and resubmit upon completion of all training. At a minimum, for each piece of equipment or system to be demonstrated, the schedule should include the following:

1. Equipment or system to be demonstrated
2. Related specification section
3. Anticipated date of training
4. Anticipated duration of training session

5. Name and company of instructor providing the training

6. Date completed

7. Actual duration of training session

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable Connecticut Building Code.

B. Electrical - Conform to state-adopted version of the National Electrical Code.

C. Conform to applicable Local Building Codes.

D. Obtain and pay for all applicable permits.

E. Schedule and pay for all inspections necessary for the electrical installation including but not necessarily limited to the general electrical inspection and fire department inspections.

1.5 PROJECT CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from the Engineer before proceeding.

C. Location of electrical equipment, devices, and similar items, as indicated, are approximate only. Exact locations are to be determined by the Contractor during construction. If any location is different from those indicated (greater than 5 feet away from location shown on Drawings), the Engineer must give approval to the change.

D. Verify in field, existing conditions and final locations of equipment installed under other Sections that require electrical work.

E. Where it is necessary to core a hole through an existing concrete slab or wall, the Contractor shall conduct a survey with a pachometer or by similar means to identify the location of steel reinforcing bars. The new hole shall be located so as to avoid cutting reinforcing bars. Where reinforcing steel is close enough together that it is not possible to core the required hole without cutting reinforcing bars, contact the Engineer for further direction before cutting a hole. Where reinforcing bars are cut without the consent of the Engineer, the slab or wall will be repaired at the expense of the Contractor.

F. Equipment wiring

1. Equipment power and control wiring is based on specific manufacturers and models. Actual wiring required may be different.

2. Before pulling any power or control wire or installing conduit, obtain equipment electrical and control installation instructions and wiring diagrams. Any discrepancies from what is shown on the electrical drawings shall be brought to the attention of the Engineer. The Engineer will provide instructions for any changes that may be necessary.

3. Installation of conduit or wire prior to obtaining the above specified information shall be at the Contractor's risk. The Owner will not be

responsible for any extra costs related to removal or replacement of conduit or wire resulting from the failure to coordinate equipment conduit and wire requirements. In the event that additional conductors or larger conductors than shown on the Drawings are required, the Owner will not be responsible for any labor costs related to the installation of these materials unless it can be demonstrated by the Contractor to the satisfaction of the Engineer that these conductors could not have been installed at the same time as the conductors shown on the Drawings.

4. Provide wiring shown on the Drawings unless specifically excluded.

G. Drawings and Specifications

1. Drawings and Specifications are typical of work done and of arrangement desired. Provide accessories and appurtenances necessary for complete installation (e.g., home runs, conduit and wire for instrumentation and control wiring) that are required to provide a complete electrical system.

H. As-Built Drawings: Maintain a master set of as-built drawings showing the changes and deviations from the Drawings or the approved shop drawings. Make markups as the changes are made.

I. Where underground electric facilities are installed, measure, record, and submit as built dimensions.

1.6 WARRANTY

A. Submit a written warranty, executed by the Contractor and manufacturer agreeing to the replacement and installation of all material, parts and adjustments required due to failure in materials or workmanship within one year from final acceptance of the Work.

B. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against any party under the Contract Documents. This warranty is in addition to all other warranties existing under either the Contract Documents or required by Law.

1.7 SEISMIC REQUIREMENTS

A. Components, systems, and their supports shall be designed by the contractor in accordance ASCE 7-10, Section 13.6 Mechanical and Electrical Components, the International Building Code (IBC 2021).

B. Submit details showing the seismic restraints.

A. Submit stamped, signed certification from a Connecticut licensed professional structural engineer that the design meets the seismic restraint requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Products shall be listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA if a listing for that product is available. NRTL shall be Underwriter's Laboratory (UL), Electrical Testing Laboratory (ETL), Factory Mutual (FM) or equal.

B. Equipment Ampere Interrupting Capacity (AIC) and/or Short Circuit Current Rating (SCCR): Electrical equipment shall be labeled in accordance with NFPA 70 and have an Ampere Interrupting Capacity rating or Short Circuit Current Rating of equal to or greater than the following:

1. 480-volt equipment: 22,000 amps
2. 208- or 240-volt equipment: 10,000 amps

2.2 FINAL SYSTEM DOCUMENTATION

A. Prior to final acceptance of the system, provide operating and maintenance manuals (O&M's) covering instruction and maintenance on each type of equipment in accordance with Section 01770.

B. The requirements for final documentation shall be as specified in Section 01770.

PART 3 EXECUTION

3.1 INSTALLATION

A. Perform all work in accordance with OSHA (Occupational Safety and Health Administration) requirements.

B. Perform all work in accordance with NFPA 70E, Handbook for Electrical Safety in the Workplace.

C. Install all equipment in accordance with manufacturer's instructions and recommendations.

D. Test all electrical components in accordance with Section 16080 and as indicated in individual electrical equipment specification sections.

E. Perform all electrical equipment installation, checkout, and test in a safe manner. Provide the following special safety precautions, as appropriate:

1. Locking and tagging procedures
2. Barricades
3. De-energization and/or isolation of equipment prior to testing
4. Review of procedures with the Engineer and the Owner
5. Erection of warning signs
6. Stationing of guards and watchmen
7. Maintenance of voice communications
8. Personnel orientation

F. Do not install electrical equipment in its permanent location until structures are weather-tight or equipment is properly protected from the weather.

G. Before energizing any machine, visually inspect for serviceability. Verify that equipment and machines have been properly lubricated and aligned. Verify nameplate for electrical power requirements.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Power system grounding
2. Electrical equipment and raceway grounding and bonding
3. Grounding of piping, tanks, handrails and other conductive equipment
4. Communication system grounding
5. Grounding electrode system three-point test

B. Related Sections

1. Section 16080 – Electrical Testing

1.2 REFERENCES

A. NFPA 70 – National Electrical Code

B. UL 467 - Grounding and Bonding Equipment

C. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors

D. UL 1059 – Terminal Blocks

E. IEEE/ANSI 142 – Latest Edition Recommended Practice for Grounding of Industrial and Commercial Power Systems.

F. IEEE 837 – Standards for Qualifying Permanent Connections Used in Substation Grounding

G. ASTM B3 - Solid Conductors

H. ASTM B8 – Assembly of Stranded Conductors

I. ASTM B33 – Tinned Conductors

J. NEMA GR1 – Ground Rods and Ground Rod Couplings

1.3 SYSTEM DESCRIPTION

A. Ground the electrical service system neutral and ground bus at the utility service entrance equipment to grounding electrodes. Grounding electrode system shall include a minimum of three driven ground rods and the rebar in accordance with NEC 250.52(A)(3). Run exposed grounding electrode conductors in conduit.

B. Ground each separately derived system neutral to the nearest effectively grounded building structural steel member or, if such is not available, to the nearest grounding electrode other than a water pipe.

C. Provide communications systems grounding conductor at point of service entrance and connect to nearest effectively grounded building structural steel member or, if such is not available, to the nearest grounding electrode other than a water pipe.

D. Bond together exposed non-current carrying metal parts of electrical equipment, handrails, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, metallic tanks and all metallic piping.

E. Install grounding in accordance with NEC Article 250.

1.4 SUBMITTALS

A. Submit shop drawings, product data, and reports.

B. Indicate layout of ground rods, location of system grounding electrode connections, and routing of grounding electrode conductor.

C. Submit ground resistance testing reports in accordance with Section 16080.

PART 2 PRODUCTS

2.1 MATERIALS

A. Grounding Electrode Conductors

1. Type: Medium-hard drawn bare copper

2. Manufacturer

a. Okonite Co.

b. Rome Cable Corp.

c. American Insulated Wire Corp.

d. Southwire

e. or equal

B. Grounding Conductors - insulated copper, minimum size #12 AWG and in accordance with NEC Tables 250.66, 250.102(C)(1) and 250.122, or larger if so indicated on the Drawings

C. Ground Rods: Copper-clad steel, ¾inch diameter, minimum length 10 feet

D. Connectors - Welded

1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used and specific types, sizes and combination of conductors and items connected.

2. Exothermic welded connections for copper to copper and copper to steel connections to ground rods, ground buses, ground wires, steel beams etc.

3. Conductors spliced with exothermic welded connections shall be considered as a continuous conductor, as stated in the noted accompanying NEC Article 250.50, 250.64 and IEEE Standard 80 latest edition.

a. Procedures outlined in the manufacturer's installation instructions shall be followed. Molds shall not be modified during installation in field applications

b. Weld metals shall be a mixture of copper oxide and aluminum. Only one weld metal mixture shall be required for each grounding connection.

c. Grounding connections shall be tested and certified in accordance with IEEE837, UL487A and UL 467.

d. Manufacturer

1) ABB Furseweld Installation Products

2) Burndy Thermoweld

3) Erico Cadweld

4) Or equal

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide a separate, insulated equipment grounding conductor with each feeder and branch circuit. Terminate each end on a grounding lug, bus, or bushing.

B. Run all exposed grounding electrode conductors and equipment grounding conductors in conduit.

C. Use a minimum of #8 AWG copper wire to ground all piping, tanks, handrails and other conductive equipment or structures including ductwork and floor gratings.

D. Use grounding bushings on all conduits stubbed up below equipment, panelboards, switchboards and motor control centers. Bond all conduits to ground bus. Use grounding bushings to ground electrical equipment and exposed non-current carrying metal parts.

E. Use the following types of ground connections for the grounding electrode system:

1. Cable to cable & cable to ground rod: Use exothermic weld type

2. Cable to structural and reinforcing steel: Use exothermic weld type

F. Supplementary Grounding Electrode: Use effectively grounded metal frame and rebar of the building and ground rods spaced a minimum of 10 feet apart in sufficient quantity to have a measured resistance to ground of not more than 5 ohms.

G. Use minimum #6 AWG copper conductor for communications service grounding conductor. Leave 10' slack conductor at terminal board.

H. Isolated Grounding Systems: Use insulated equipment grounding conductor and connect only to service grounding electrode.

I. Drive ground rods one foot below finished grade.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation and compliance with NEC Article 250.

3.3 TESTING

A. Perform ground tests using a low resistance, Null balance type, ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.

B. Test the grounding electrode system using a fall of potential three-point test and measure ground resistance. Submit tabulation of results to the Engineer. Include identification of electrodes, date of reading and ground resistance value in the test reports. If the resistance is not 5 ohms or less, contact the Engineer. The Engineer will initiate design changes, if necessary, to obtain acceptable values of ground resistance.

C. Ground resistance of conduits, equipment cases, and supporting frames, shall not vary from that of system as a whole and shall not exceed 0.5 ohms to ground. Measure resistance to ground of representative items, as directed by the Engineer. Submit all readings to the Engineer.

END OF SECTION

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SECTION 16070

ELECTRICAL HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Support channel
2. Fastening hardware
3. Anchor bolts

1.2 REFERENCES

A. ASTM A-780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dipped Galvanized Coatings

1.3 SUBMITTALS

A. Submit shop drawings, product data, and reports.

1.4 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.1 SUPPORT CHANNEL

A. Support channel shall be stainless steel in the wetwell and hot dipped galvanized steel elsewhere.

B. Support channel assembly hardware shall be galvanized steel in the building and stainless steel elsewhere.

C. In wet locations, support channel components in contact with the floor shall be stainless steel.

D. Manufacturer:

1. Unistrut
2. B-Line
3. ABB Super Strut Installation Products
4. Or equal

2.2 FASTENING HARDWARE

A. All fastening hardware shall be 304-stainless steel galvanized steel in the building and stainless steel elsewhere.

2.3 ANCHOR BOLTS

A. Anchor bolts shall be suitable for cracked or uncracked concrete and CMU construction.

B. Anchor bolts, nuts, washers, bolt sleeves, and assembly hardware shall be Type 316 stainless steel.

C. Use expansion anchors in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces.

D. Manufacturer:

1. Hilti, Kwik-Bolt TZ SS 316
2. Powers Fasteners, Power-Stud+ SD6
3. Simpson Strong-Tie, Strong-Bolt 2
4. Or Equal

2.4 PIPE CLAMPS AND STANDOFFS

A. Pipe clamps and standoffs shall be one hole, galvanized malleable iron type. They shall be of the same manufacturer and shall be designed to be used together.

B. Strut pipe clamps shall be 2-piece type galvanized steel.

C. The finish shall be suitable for the piping system being supported. For PVC conduit, stainless steel or PVC coated clamps and standoffs shall be used.

2.5 THREADED RODS

A. Threaded hanging rods shall be 304 stainless steel and be one piece. The size shall be suitable for the loads being supported.

2.6 POLYMER HOUSEKEEPING PAD

A. Polymer housekeeping pads are an acceptable alternative for concrete pads and can be utilized for indoor applications.

B. Polymer composite with 18,000 PSI of compressive strength and 1,900 PSI of tensile strength.

C. Flame spread index shall be Class A per ASTM E84.

D. Pad height: 4”

E. Coordinate dimensions and conduit openings with equipment manufacturers.

F. Provide with anchor mounts for fastening to floor.

G. Provide with stainless steel equipment anchors (coordinate with equipment requirements)

PART 3 EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, preset inserts or beam clamps. Do not use spring steel clips and clamps.

B. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

C. Do not use powder-actuated anchors.

D. Hanger rods shall be subjected to tension only. Lateral and axial movements shall be accommodated by proper linkage in the rod assembly.

E. Fabricate supports from support channel rigidly welded or bolted to present a neat appearance. Galvanized structural steel may be used where galvanized support channel is allowed. Use hexagon head bolts with spring lock washers under all nuts. Coat ends of galvanized steel channel that has been cut with zinc-rich paint in accordance with ASTM A-780.

F. Install freestanding electrical equipment on 4 inch concrete housekeeping pads.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide channel supports to stand cabinet 1 inch off wall.

H. Bridge studs top and bottom with galvanized steel channels to support flush-mounted cabinets and panelboards in stud walls.

I. Use standoffs for all surface mounted conduit to maintain ¼ inch space between conduits and walls.

END OF SECTION

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SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Nameplates

2. Wire and cable markers

1.2 REFERENCES

A. NEMA WC5 - Thermoplastics - Insulated Wire and Cable for Transmission and Distribution of Electrical Energy

B. ANSI C57

1.3 SUBMITTALS

A. Provide schedule for nameplates.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Engraved two-layer plastic, white letters on a black background

B. Nameplate Wording:

1. Wording of the nameplates shall be in conformance with Drawings and acceptable to the Owner.

2. Wording of the nameplates for each piece of equipment shall be based on the common name and tag number (when applicable) of the equipment.

2.2 WIRE AND CABLE MARKERS

A. Wires up to AWG10: Split sleeve or tubing type waterproof markers (Thomas & Betts, Panduit, Burndy or equal).

B. Wires AWG8 and larger: Plastic impregnated cloth markers, resistant to abrasion, moisture, dirt and oil (Ideal, Panduit, Brady or equal).

PART 3 EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines.

C. Secure nameplates to equipment fronts using ASA Type U drive screws, and water-resistant adhesive. Secure nameplate to face of panelboard doors one third of the way down from the top of the door. Embossed tape will not be permitted for any application.

3.2 WIRE IDENTIFICATION

A. Provide wire markers on each end of each conductor in panelboard gutters, pull boxes, outlet and junction boxes, switchgear, switchboards, motor control centers, control panels, at each load connection and at each terminal board connection. Identify wiring as following:

1. Power and lighting circuit wires: Wire markers shall identify (a) power source/panelboard name and circuit ID number (e.g. "LP-1,2,3"), and (b) load/equipment name (e.g. "VFD 1").

2. Control & signal wiring: The identification on wire markers shall match the ID tag number of the wire/terminal shown on the associated equipment shop drawings.

B. Circuits passing through junction boxes shall be individually grouped and bound with Ty-raps.

C. Include the following color coding of all conductors used for power or lighting circuits.

1. 120/208-volt, three phase 4 wire

a. Black - Phase A

b. Red - Phase B

c. Blue - Phase C

d. White - Neutral

e. Green - Equipment ground

2. 277/480-volt, 3 phase 4 wire

a. Brown - Phase A

b. Orange - Phase B

c. Yellow - Phase C

d. Gray - Neutral

e. Green - Equipment ground

D. Color coding of multiconductor control cables shall be in accordance with NEMA Standard WC5.

3.3 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates of minimum letter height as scheduled below.

B. Panelboards - ¼ inch to identify equipment designation, 1/8 inch to identify voltage rating and source.

C. Switches in Panelboards - ¼ inch to identify circuit and load served, including location.

D. VFDs - ¼ inch to identify circuit and load served, including location.

E. Individual Circuit Breakers, Enclosed Switches, Remote Operator Stations, Time Clocks, Control Devices, and Motor Starters – 1/8 inch to identify load served.

F. Transformers - ¼ inch to identify equipment designation, 1/8 inch to identify primary and secondary voltages, primary source, and secondary load and location. Power transformer nameplates shall be in accordance with ANSI C57.

G. Pumps, fans, and other electrical equipment - ¼ inch to identify circuit and equipment designation.

H. Equipment with More Than One Power Source, Including Motors with Heaters - ¼ inch to identify power sources. Mount nameplate on motor disconnect switch, equipment enclosure, or other prominent location.

END OF SECTION

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SECTION 16080

ELECTRICAL TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Testing of Electrical Systems - General
2. Electrical Test Equipment
3. Electrical Test Procedures
4. Specific Electrical Tests
5. System Function Tests

B. Related Sections

1. Section 16060 – Grounding and Bonding
2. Section 16075 – Electrical Identification

1.2 REFERENCES

A. NFPA 79 – Electrical Standard for Industrial Machinery

B. ANSI/ISA-S5.4 – Instrument Loop Diagrams

C. ANSI C37

1.3 SUBMITTALS

A. General: Testing shall be performed, with satisfactory results, prior to connecting and energizing equipment. Problems discovered as a result of testing shall be corrected and retesting performed prior to connecting and energizing equipment.

B. The following test reports shall be submitted

1. Motor test results
2. Megger test results
3. Wire and cable continuity test results
4. Grounding system test results
5. System functional test reports

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 TESTING OF ELECTRICAL SYSTEMS - GENERAL

A. Provide supervision, labor, materials, tools, test instruments and other equipment or services and expenses required to test, adjust, set, calibrate, and operationally check work and components of the various electrical and control systems and circuitry throughout the contract.

B. Pay for all tests specified in Division 16, including expenses incident to re-tests occasioned by defects and failures of equipment to meet specifications. Unless otherwise specified, the Owner will supply the electric current necessary for tests.

C. After completion of testing replace wiring and equipment found defective (defined as failing to meet specified requirements).

D. Do not void equipment warranties or guarantees by testing and checkout work. Checks and tests shall be supplemental to and compatible with the manufacturer's installation instructions. Where deviations are apparent, obtain the manufacturer's approved review of procedure prior to testing. Where any repairs, modifications, adjustments, tests or checks are to be made, contact the Engineer to determine if the work should be performed by or with the manufacturer's representative. All checks and tests specified for proper operating and safety of equipment and personnel are to be performed concurrent with progression of the work, prior to final acceptance by the Owner.

E. At any stage of construction and when observed, any electrical equipment or system determined to be damaged, or faulty, is to be reported to the Engineer. Corrective action requires Engineer’s approval prior to re-testing, and inspection.

F. Prior to testing and start-up, equipment and wiring shall be properly and permanently identified with nameplates, and other identification as specified in Section 16075. Check and tighten terminals and connection points, remove shipping blocks and thoroughly clean equipment, repair damaged or scratched finishes, inspect for broken and missing parts and review and collect manufacturer's drawings and instructions for delivery to the Engineer. Make routine checks and tests as the job progresses to ensure that wiring and equipment is properly installed.

G. Testing and checkout work is to be performed with fully qualified personnel skilled in the particular tests being conducted. Personnel are to have at least 5 years of experience with tests of same type and size as specified.

H. Conduct tests in presence of the Engineer. Notification is required 7 calendar days or more in advance when any test is to be performed, and do not start tests without approval.

I. Make openings in circuits for test instruments and place and connect instruments, equipment, and devices, required for the tests. Upon completion of tests, remove instruments and instrument connections and restore circuits to permanent conditions.

J. Identify test being performed, conductor or equipment the test is being performed on, date the test was performed, value of test results, person performing the test, the witness to the test, and the serial and model number and description of test instrument. Arrange information in tabular form and submit to the Engineer for approval.

K. When the electrical tests and inspections specified or required within Division 16 are complete and results reported, reviewed, and approved, that portion of the electrical

equipment system or installation may be considered electrically complete. Affix appropriate, approved, and dated completion or calibration labels to the tested equipment and notify the Engineer of electrical completion. If the Engineer finds completed work unacceptable, he will notify the Contractor in writing of unfinished or deficient work, with the reason for his rejection, to be corrected by the Contractor. The Contractor will notify the Engineer in writing when exceptions have been corrected. The Contractor will prepare a "notification of Substantial Electrical Completion" for approval by the Engineer following the Engineer's acceptance of electrical completion. If later in-service operation or further testing identifies problems attributable to the Contractor, these will be corrected.

3.2 ELECTRICAL TEST EQUIPMENT

A. Test equipment used is to be inspected and calibrated.

B. Perform calibration and setting checks with calibrated test instruments of at least twice that of the accuracy of the equipment, device, relay or meter under test. Dated calibration labels shall be visible on test equipment. Calibrations over 6 months old are not acceptable on field test instruments. Inspect test instruments for proper operation prior to proceeding with the tests.

C. Perform ground tests using a low resistance, Null balance type, ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.

3.3 TEST PROCEDURES

A. Prepare procedures and schedules for the work specified herein. This work is to be coordinated and compatible with both the work and schedule of the other crafts. Sequence the tests and checks so that the equipment can be energized immediately after the completion of the application tests.

B. The test procedures shall provide specific instructions for the checking and testing of each electrical component of each system. Schedule tests and inspections as the job progresses.

C. Testing and checkout work shall be conducted in a safe manner. Provide the following special safety precautions, as appropriate:

1. Locking and tagging procedures
2. Barricades
3. Deenergization and/or isolation of equipment prior to testing
4. Review of procedures with the Engineer and Resident Project Representative
5. Erection of warning signs
6. Stationing of guards and watchmen
7. Maintenance of voice communications
8. Personnel orientation

D. Before energizing any machine, visually inspect for serviceability. Check manufacturer's instruction manual for correct lubrication and ventilation. Align motor with driven equipment. Check nameplate for electrical power requirements.

E. Insulation resistance measurements for motor feeders shall be performed with motors disconnected, measure insulation resistance from load side of contactors or circuit breakers.

F. Perform insulation tests at the following times and conditions:

1. Prior to energization and/or placing into service.

2. When damage to the insulation is suspected or known to exist.

3. After repairs or modifications to the equipment affecting the insulation.

4. Where lightning or other surge conditions are known to have existed on the circuit.

G. Where ground test results identify the need for additional grounding conductors or rods that are not indicated or specified, design changes will be initiated to obtain the acceptable values.

3.4 SPECIFIC ELECTRICAL TESTS

A. Motors

1. Perform insulation tests on motor windings and record results.

2. Test run motors 1 HP and above uncoupled or unloaded, before placing into operation. Check the motor for rotation, speed, current and temperature rise under normal load and record the results.

B. Wire and Cable

1. For all 480 volt circuits, megger test the insulation of every external circuit wire to each other and to ground. Tests shall be conducted at voltages of 1,000 V DC and record results.

2. Continuity test each control and/or low voltage (below 480 volts) wire and cable to verify the field applied tag per conductor and record results.

C. Perform insulation tests on electrical equipment, apparatus, generators, transformers, power circuit breakers and switches, and similar electrical equipment.

D. Relay Panels, Operator and Instrument Control Panels, Programmable Controllers, Micro-Processors, Battery Systems and Other Miscellaneous Equipment

1. Upon completion of equipment installation, visually and functionally test equipment and their control devices for tightness of connections and for proper operation. In the case of battery systems, static inverters and similar equipment, follow manufacturer's recommended test and installation manuals upon review and approval by the Engineer. In the case of operator, instrument, and relay panels and cabinets or devices used solely for control, functionally test each circuit for proper operation and compliance with the Drawings and Specifications. Where functional testing is deemed undesirable by the Engineer from a safety or plant operational standpoint, then continuity and terminal connection verification checks will be acceptable.

E. Grounding Systems

1. Test in accordance with Section 16060.

3.5 SYSTEM FUNCTION TESTS

A. It is the purpose of system function tests to prove the correct operation of systems/equipment and correct interaction of all sensing, processing, and action devices.

B. Perform system function tests upon completion of the maintenance tests defined, as system conditions allow. Document results and submit a detailed report for all functional tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements and manufacturer's published data.

2. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.

3. Verify the correct operation of all sensing devices, alarms, and indicating devices.

4. Verify communication assisted protection schemes via end-to-end testing.

5. Measure latency of communication lines for pilot wire, line differential and transfer trip protection schemes.

6. Function test bus restoration and/or transfer switches.

7. Verify correct metering on protective relays and meters.

8. Verify control circuits and current transfer circuits are restored to normal operation.

9. Verify communication lines are operational for local and remote devices.

10. Verify control annunciation systems are left with no alarms and any alarms present shall be investigated.

C. Verify systems are left in normal operating mode or position, transfer and restoration schemes are enabled, and monitoring and protection devices are operational.

END OF SECTION

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SECTION 16120

CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Building wire and cable
2. Shielded signal cable
3. VFD Cable
4. Ethernet cable
5. Wire connectors

B. Related Sections

1. Section 16075 - Electrical Identification

1.2 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

1.3 SUBMITTALS

A. Submit shop drawings, product data and reports.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Determine required separation between cable and other work.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required. Determine cable routing to avoid interference with other work.

PART 2 PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Description: Stranded conductor insulated wire, multi-conductor control cable and tray cable.

B. Conductor: copper

C. Insulation Voltage Rating: 600 volts

D. Insulation: ANSI/NFPA 70; all power and control wiring shall be XHHW-2 unless otherwise indicated in this specification.

E. Manufacturer

1. Okonite Co.
2. Rome Cable Corp.
3. American Insulated Wire Corp.
4. Southwire
5. or equal

2.2 SHIELDED SIGNAL CABLE

A. Description: twisted pair shielded instrumentation wire, NEC type TC listed, wet location, approved for Class 1 circuits as permitted in NEC Article 725.

B. Conductor: tinned copper 18 AWG

C. Insulation Material: PVC with a nylon overcoat

D. Insulation Temperature Rating: 75°C wet, 90°C dry

E. Shield: 100% coverage, with drain wire

F. Jacket: 90°C PVC

G. Insulation voltage rating: 600 volts

H. Manufacturer

1. Belden No. 9341
2. Approved equal by Alpha
3. Approved equal by Clifford
4. or equal

2.3 ETHERNET CABLE

A. Description: NEC CMR cable, Category 6 unbonded-pair cable

B. Construction: 23 AWG solid bare copper, 4 twisted pairs, overall shield, drain wire, RJ-45 compatible, non-plenum, polyolefin (PO) or PO+FEP insulation, PVC jacket.

C. Manufacturer

1. Belden 2412F
2. Approved equal by Alpha
3. Approved equal by Quabbin

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Minimum size for power wiring shall be AWG #12.

B. Minimum size for control wiring shall be AWG #14.

C. All wiring shall be run in conduit, unless otherwise noted.

D. Install products in accordance with manufacturer's instructions.

E. Use stranded conductors for all wire sizes.

F. In raceways, mechanically complete the installation in all details. Pull all conductors into raceway at same time.

G. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

H. Protect exposed cable from damage.

I. Use suitable cable fittings and connectors.

J. Neatly train and lace wiring inside boxes, equipment, and panelboards.

K. Clean conductor surfaces before installing lugs and connectors.

L. Instrumentation, control and signal wiring shall be continuous with no splices from source to destination, unless otherwise shown on drawings.

M. Splices

1. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

2. Properly connect and insulate shields at all splice points.

3. Above grade splices

a. 8 AWG and Larger: Use split bolt connectors for copper conductor splices and taps. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

b. 10 AWG and smaller: Use insulated spring wire connectors with plastic caps for copper conductor splices and taps.

N. Ground signal cable shields on receiving end only.

O. Provide Kellems grips for all cord connected devices.

P. Provide separation of power wiring from control and signal wire in accordance with NEC Article 725.

Q. Install Ethernet cables in accordance with manufacturer's instructions and industry standards for category 6 wiring.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Section 16075.

B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.5 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

END OF SECTION

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SECTION 16131

CONDUIT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Galvanized rigid steel conduit
2. Stainless steel conduit
3. Non-metallic (PVC) conduit
4. Liquidtight flexible conduit
5. Fittings and conduit bodies
6. Conduit wall seals
7. Underground warning tape
8. Conduit expansion joint
9. Conduit sealing bushing
10. Cold galvanizing compound
11. Explosion proof sealing fittings

B. Related Sections

1. Section 16060, Grounding and Bonding
2. Section 16070, Electrical Hangers and Supports

1.2 REFERENCES

A. ACI 318 – Building Code Requirements for Structural Concrete

B. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

C. ANSI/NFPA 70 - National Electric Code

D. ANSI C80.1 - Galvanized Rigid Steel Conduit, Zinc Coated

E. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing

F. UL-6 – Standard for Rigid Metal Conduit

1.3 SUBMITTALS

A. Shop drawings, product data and reports

B. Riser Diagrams for the electrical installation

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

D. Provide complete conduit systems between electrical equipment and devices as required.

PART 2 PRODUCTS

2.1 GENERAL CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch unless otherwise specified

B. Outdoor locations:

1. Exposed: Use galvanized rigid steel conduit

2. Buried: Use schedule 40 PVC conduit, concrete encased where run below pavement.

3. Buried-to-exposed conduit transitions shall be made below grade.

C. In the wetwell: Use stainless steel conduit

D. Class 1 Division 1 and 2 Hazardous Locations

1. Provide sealing fittings at each entrance to enclosure housing an arcing device. Locate seal fittings as close as possible, in no case more than 18 inches.

2. Provide seal fittings for each conduit leaving hazardous (Class 1 Division 1 or 2) area.

3. Use conduit seal fittings appropriate for conduit orientation.

4. Use conduit sealing compound with fiber dam in compliance with manufacturer's recommendations.

5. Provide junction boxes rated for hazardous locations.

E. All Other Locations:

1. Concealed: Use galvanized rigid steel conduit

2. Exposed: Use galvanized rigid steel conduit

F. Connections to portable equipment from junction boxes and connections to all motors: use liquid tight flexible conduit, metallic where metallic conduit is used and nonmetallic where nonmetallic conduit is used.

1. Minimum Length: 12 inches

2. Maximum Length: 36 inches

2.2 GALVANIZED RIGID STEEL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings

C. Hot dipped galvanized inside and outside with additional passivation coating for extra protection.

2.3 STAINLESS STEEL CONDUIT AND FITTINGS

A. Stainless steel rigid conduit and fittings shall be UL listed to UL61 and UL classified to CSA C22.2 No. 45.2. Shal comply with ASTM A-321/SA-312 and ANSI C80.1.

B. Stainless steel conduit and fittings shall be type 316.

C. Conduit shall provide NPT thread and each conduit and shall be provided in standard 10-foot lengths.

D. All couplings, fittings and hardware shall be provided by same manufacturer.

E. Manufacturer

1. ABB Installation Products

2. Allied Conduit

3. Calbrite

4. Gibson Conduit

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Description: Interlocked steel construction with PVC jacket

B. Liquidtight flexible metal conduit and fittings shall be appropriate outer jacket and metallic core for application requirements.

C. For use where metallic conduit is used.

D. Fittings: ANSI/NEMA FB 1. Fittings shall be gasketed. Material shall be zinc-coated in dry locations, galvanized in wet and damp locations, and stainless steel in corrosive locations.

E. Manufacturer

1. ABB Installation Products

2. Carlon

3. Anamet

4. Electriflex

5. Or equal

2.5 NONMETALLIC (PVC) CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC

B. Fittings: NEMA TC3

2.6 CONDUIT WALL SEALS

A. Type - Suitable for core drilled holes

B. Manufacturer

1. O-Z Gedney, Type CSM

2. Equal by Crouse-Hinds

3. Or equal

2.7 UNDERGROUND WARNING TAPE, DETECTABLE

A. Warning tape for all buried electrical conduit shall be solid aluminum foil core tape and printed with the words “CAUTION - BURIED ELECTRICAL LINE BELOW.”

B. Tape shall be red and 6 inches wide.

C. Manufacturers

1. Ideal Industries

2. Cable Accessories

3. E. L. S. Products Corp

4. Or equal

2.8 FITTINGS AND CONDUIT BODIES

A. Fittings

1. Description - Threaded, malleable Iron. Material and coating to correspond with type of conduit system being used, galvanized where galvanized steel conduit is used, PVC where PVC conduit is used and stainless steel where stainless steel conduit is used.

B. Conduit Bodies

1. Description - Threaded, malleable Iron or copper-free aluminum. Material and coating to correspond with type of conduit system being used, galvanized where galvanized steel conduit is used, PVC where PVC conduit is used, and PVC-coated where PVC-coated conduit is used.

2. Manufacturer

a. Appleton-Type Mogul - malleable iron or copper-free aluminum

b. Equal by ABB Installation Products

c. Equal by O-Z Gedney

d. Equal by Crouse-Hinds

e. or equal

C. Conduit Hubs

1. Manufacturer

a. Crouse Hinds – Myers hub Type HUB

1) Galvanized steel in damp and wet locations

2) Stainless steel in corrosive locations

3) Zinc coated steel in dry locations

b. Equal by O-Z Gedney

c. Equal by RACO

d. Equal by Appleton

e. or equal

2.9 CONDUIT EXPANSION JOINT, RIGID METAL CONDUIT

A. Weather tight, internal ground, expansion joint for galvanized rigid steel conduit, 4 inch maximum conduit movement.

B. Manufacturer

1. ABB Type XJG Installation Products

2. Crouse-Hinds Type XJG

3. Appleton Type XJ

4. O-Z Gedney Type AX

5. or equal

2.10 CONDUIT EXPANSION AND DEFLECTION FITTING, PVC

A. Expansion fitting for PVC conduit shall compensate for length changes due to temperature variations in exposed conduit runs, 4-inch maximum conduit movement.

B. Manufacturer

1. ABB NM-XD Type Installation Products

2. Equal by Carlon

3. Or equal

2.11 CONDUIT SEALING BUSHING

A. Description: Bushing that provides a waterproof seal around wire and cables in a conduit

B. Construction: Slotted PVC coated steel discs, neoprene sealing ring and stainless-steel head cap screws and washers

C. Manufacturer

1. O-Z Gedney Type CSBI

2.12 COLD GALVANIZING COMPOUND

A. Cold galvanizing compound shall be applied to all field threads and shall be as manufactured by ZRC Products Company, a division of Norfolk Corp. or equal.

2.13 EXPLOSION PROOF SEALING FITTINGS

A. Description: Explosion proof and dust-ignition proof sealing fitting. Material and coating to correspond with type of conduit system being used.

B. Ratings:

1. Class I, Division 1 and 2, Groups A, B, C, D

2. Class II, Division 1, Groups E, F, G

3. Class II, Division 2, Groups F, G

4. Class III

C. Bodies: Feraloy iron alloy, ductile iron

D. Plugs: Feraloy iron alloy, steel

E. Removable Nipples: steel

F. Manufacturer:

1. Crouse-Hinds type EYS

2. Approved equivalent

G. Sealant:

1. Crouse-Hinds Chico X fiber and Chico A sealing compound or Chico Speed Seal

2. Sealant system of sealing fitting manufacturer selected

PART 3 EXECUTION

3.1 INSTALLATION

A. Junction boxes shown on the Drawings shall be provided in locations indicated. Additional boxes shall be provided as needed to comply with NFPA 70 requirements.

B. Install conduit in accordance with NECA "Standards of Installation."

C. Install nonmetallic conduit in accordance with manufacturer's instructions.

D. Arrange supports to prevent misalignment during wiring installation.

E. Support rigid steel conduit using galvanized steel or galvanized malleable iron straps, pipe hangers, U-bolt clamps and beam clamps.

F. Group related conduits; support using conduit rack. Construct rack using support channel; provide space on each for 25 percent additional conduits.

G. Fasten conduit supports to building structure and surfaces under provisions of Section 16070.

H. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

I. Do not attach conduit to ceiling support wires.

J. Arrange conduit to maintain headroom and present neat appearance.

K. Route exposed conduit parallel and perpendicular to walls.

L. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

M. Maintain adequate clearance between conduit and piping.

N. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104°F.

O. Cut conduit square using saw or pipe cutter; de-burr cut ends.

P. Before installation of wires and cables, clean and dry inside of each conduit run.

Q. For galvanized conduit, apply cold galvanizing compound to all field threads.

R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fittings. Allow joint to cure for 20 minutes, minimum.

S. Use conduit hubs to fasten conduit to boxes and enclosures in damp locations, wet locations, and locations below fluid piping. For wet and corrosive locations, use stainless steel conduit hubs.

T. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.

U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

V. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints per Manufacturer's best practice and recommendations.

W. Provide 100-lb. test nylon pull string in each conduit 2 inch or larger except sleeves and nipples.

X. Use suitable caps (cast metal or thermoplastic) to protect installed conduit against entrance of dirt and moisture.

Y. Ground and bond conduit in accordance with Section 16060.

Z. Install rigid metal conduit using only threaded fittings.

AA. Use two locknuts, one inside and one outside of each box and enclosure in dry locations.

BB. Install a chromium plated, spun or split type escutcheon on all exposed conduits passing through walls or ceilings.

CC. Extend pipe sleeves 3/4 inch above finished floors.

DD. Install a water resistant caulking around all conduits passing through floors.

EE. Provide a separate conduit run for each 480V power circuit, unless otherwise shown on drawings.

FF. Provide a separate conduit run for the output power wiring of each VFD.

GG. Provide separate conduit runs for 480 and 120/208volts systems. Install motor feed and control wiring in the same conduit only when shown on the Drawings or as approved by the Engineer.

HH. Arrange for all duct bank systems to drain away from buildings. Install duct bank systems to drain toward manholes or handholes.

II. Provide thru wall seals on all conduits passing through foundation walls.

JJ. Provide a 4 inch band of black asphaltic paint, 2 inches in the concrete and 2 inches above floor, at all galvanized rigid steel conduit floor penetrations in pump chambers, tunnels, cellars and other below grade high moisture areas.

KK. Provide a 4 inch band of black asphaltic paint, 2 inches in the concrete and 2 inches in the soil, at all galvanized rigid steel penetrations through floors or walls into soil.

LL. Use PVC conduit fittings and bodies with PVC conduit.

MM. Install underground warning tape 12 inches above all underground conduits.

NN. Install underground conduit with minimum cover, in accordance with National Electric Code or utility requirements, but no less than 36 inches.

OO. For non-concrete encased underground conduit installations, backfill the trench with sand borrow for the full width of the trench (at least 3-inches around sides and bottom of conduit) and extend the sand borrow 12-inches over the conduit.

PP. For penetrations in existing walls, patch with mortar and touch up paint. Match existing paint color.

QQ. For penetrations in fire rated walls, use materials that maintain the fire rating of the wall.

RR. Conduit penetrations in the walls of the wetwell shall be located above the maximum water elevation.

SS. Provide conduit expansion joints for underground conduits that enter a building through an exterior wall or connect to an exterior mounted disconnect switch, meter, or other equipment.

TT. Provide explosion proof sealing fittings where indicated on the Drawings and where required by code.

END OF SECTION

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SECTION 16136

BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Wall and ceiling outlet/device boxes
2. Pull and junction boxes
3. Covers
4. Conduit Hubs

1.2 REFERENCES

A. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies

B. NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum)

C. UL514 A – Metallic Outlet Boxes

D. UL514 C – Nonmetallic Outlet Boxes, Flush-Device Covers and Covers

1.3 SUBMITTALS

A. Shop drawings, product data, and reports

1.4 PROJECT CONDITIONS

A. Verify that the field measurements are as shown on the Drawings.

B. Verify locations of outlets in offices and work areas prior to rough-in.

C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 5 feet of location shown.

1.5 DESIGN REQUIREMENTS

A. Unless otherwise specified or indicated on Drawings, NEMA rating for boxes shall correspond as follows to location classifications indicated on Drawings. Indoor locations for which a classification is not indicated are to be considered dry locations unless otherwise designated by Code. Outdoor locations are to be considered wet locations unless otherwise indicated.

1. Dry locations - NEMA 1 Metallic Boxes
2. Damp locations and Wet locations - NEMA 4 Metallic Boxes
3. Corrosive locations - NEMA 4X Metallic Boxes
4. Class 1 Division 1 or 2 Group D - NEMA 7, gasketed , cast aluminum Boxes

PART 2 PRODUCTS

2.1 WALL AND CEILING OUTLET/DEVICE BOXES

A. Cast Metal Outlet/Device Boxes

1. NEMA FB 1, Type FD, cast iron or copper-free aluminum with internal green grounding screw terminal.

2. Shall be suitable for use in wet locations when used with gasketed covers.

3. Cover shall be by box manufacturer and shall have stainless steel cover screws and a neoprene gasket.

4. Boxes shall have external mounting feet cast into the box assembly; screw-in feet will not be acceptable.

5. Material and coating shall match that of the conduit system being used.

6. Provide threaded sealing conduit hubs on all conduit entries.

7. Acceptable Manufacturers

a. ABB Installation Products

b. Crouse-Hinds

c. Appleton

d. Hubbell

e. or equal

2.2 PULL AND JUNCTION BOXES

A. Sheet Metal Pull and Junction Boxes

1. NEMA OS 1, Galvanized or Painted Steel.

2. Provide green grounding screw.

3. Boxes shall not contain knockouts.

4. Acceptable Manufacturers

a. ABB Steel City Installation Products

b. Raco

c. Appleton

d. or equal

B. NEMA 4X Stainless Steel Pull and Junction Boxes

1. NEMA OS 1, Type 4X Stainless Steel (16 gauge minimum). Screws shall be stainless steel.

2. Provide green grounding screw.

3. Acceptable Manufacturers

a. Hoffman, Inc.

b. McKinstry

c. Wiegmamn

d. or equal

C. Cast Metal Pull and Junction boxes

1. NEMA FB 1, type 4 cast iron or copper-free aluminum

2. Shall be suitable for use in wet locations when used with gasketed covers.

3. Cover shall be by box manufacturer and shall have stainless steel cover screws and a neoprene gasket.

4. Material and coating shall match that of the conduit system being used.

5. Boxes shall have external mounting feet cast into the box assembly, screw-in feet will not be acceptable.

6. Provide threaded sealing conduit hubs on all conduit entries.

7. Provide green grounding screw.

8. Acceptable Manufacturers

a. Crouse-Hinds

b. Appleton

c. Hubbell, Inc.

d. or equal

e.

D. Boxes exceeding 48 inches in any direction shall be provided with angle iron stiffeners.

2.3 NEMA 7 EXPLOSION-PROOF BOXES

A. Boxes shall be rated for the hazardous classification of the area, Class I, Division 1, Division 2, etc.

B. Boxes shall be cast metal; material and coating shall match that of the conduit system being used.

2.4 COVERS

A. Provide covers for all boxes. Cover material and coating shall match the box, unless otherwise specified. Covers shall be screw fastened or hinged and comply with NEMA Standards OS 1, OS 2 or FB 1.

2.5 CONDUIT HUBS

A. Conduit hubs shall be threaded and sealing type with neoprene gasket.

B. Conduit hub material and coating shall match that of the conduit.

C. Acceptable Manufacturers

1. ABB Thomas & Betts - type "BULLET"

2. Crouse Hinds - type "HUB"
3. Equal by Appleton
4. or equal

PART 3 EXECUTION

3.1 INSTALLATION

A. Install electrical boxes as shown on Drawings. Provided additional boxes as required to comply with NFPA 70 requirements, for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Provide separate boxes for 480 and 120/208 volts systems. Install motor feed and control wiring in the same box only when shown as combined in a single raceway on the Drawings or as approved by the Engineer.

C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

D. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

E. Fasten boxes to walls, ceilings or strut supports; do not support boxes from equipment, panels, etc.

F. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

G. Use gang box where more than one device is mounted together. Do not use sectional box.

H. Provide permanent barriers in common boxes to limit voltage between adjacent switches to 300 volts or less.

I. Common boxes used for gang installation with switches, receptacles, and low voltage devices shall include barriers between the devices and the switches or receptacles.

J. Through-the-wall outlet boxes shall not be permitted. Outlet boxes shall not be installed back-to-back but shall be staggered on opposite sides of partitions a minimum of 12" on center.

K. The Contractor shall furnish and install outlet boxes for all wiring devices as shown on the drawings.

L. Use sealing conduit hubs on all conduit entries in wet and damp locations.

M. Use stainless steel pull and junction boxes in locations rated as Wet and/or Corrosive.

3.2 ADJUSTING

A. Install knockout closure in unused box opening.

END OF SECTION

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SECTION 16137

CONTROL CABINETS AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Cabinets and Construction
2. Control Devices
3. Surge Protective Device (DC Signal)
4. Surge Protective Device (AC Signal)
5. DC Power Supply
6. Panel Accessories

B. Related Sections

1. Section 16070 – Electrical Hangers and Supports
2. Section 16490 – Components and Accessories

1.2 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1,000 volts Maximum)

B. ANSI/NEMA ICS 1 – General Standards for Industrial Control and Systems

C. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems

D. NFPA 70 – Article 409, Industrial Control Panels

E. NFPA 79 – Electrical Standard for Industrial Machinery

F. UL 508A – Standard for Industrial Control Panels

1.3 SUBMITTALS

A. Shop drawings, product data, and reports

B. Shop Drawings for Equipment Panels: Include project-specific wiring schematic diagram (with wire numbers for all wires), outline drawing, construction diagram and dimensions as described in ANSI/NEMA ICS 1 and NFPA 79

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NEC Article 409, NFPA 79, UL 508A, UL 698Aand all local and federal regulations.

B. Provide appropriate UL label on panel for the completed panel assembly. Panels received without label shall be subject to a field inspection, rework, and/or replacement at the Contractor's expense.

1. UL 508A – For panels in unclassified locations

2. UL 698A – For panels in unclassified locations with intrinsically safe circuit extensions into Class I, II, and III, Division 1 and 2 hazardous (classified) locations

PART 2 PRODUCTS

2.1 CABINETS

A. Construction: NEMA 250, or below

B. Cabinet materials and ratings shall be as follows (unless otherwise specified or indicated on the drawings):

1. Dry Locations: NEMA 12 metallic

C. Finish: Metallic cabinets shall have a brushed finish

D. Covers: Continuous hinge held closed by flush latch operable by screwdriver or handle

E. Panel for Mounting Terminal Blocks or Electrical Components: 12 gauge steel, white enamel finish

2.2 CONTROL SWITCHES AND PILOT DEVICES

A. Provide in accordance with Section 16490.

2.3 CONTROL RELAYS

A. Provide in accordance with Section 16490.

2.4 TERMINAL BLOCKS

A. Type - Modular construction type, 35mm DIN rail mounted, tubular pressure screw connectors

B. Physical

1. Wire Size: 22-10 AWG

2. Rated Voltage: 600 V

3. Rated Current: 30 A

C. Manufacturer

1. Allen Bradley

2. Equal by Entrelec

3. Equal by Phoenix Contact

4. Or equal

2.5 DIN RAIL

A. DIN rail shall be zinc plated steel and chromate passivated. Rail shall be 35mm wide and 7.5mm or 15mm deep. Rails may be raised with conductive standoffs. Raised rails shall be 15mm deep. Rails shall not be angled.

2.6 ALARM HORN

A. Provide in accordance with Section 16490.

2.7 ALARM LIGHT

A. Provide in accordance with Section 16490.

2.8 SURGE PROTECTIVE DEVICE (DC SIGNAL)

A. Provide SPD for all signal wires that extend outside the building/structure/enclosure where the panel is located.

B. Requirements

1. Conform with IEC/EN 61643-21.

2. Removable from terminal base for testing/replacement without unwiring.

3. Direct-grounding of reference potential preferred where permitted by circuit design.

4. Visual status indicator with option for remote monitoring.

5. Multi-stage (not single-stage) protection.

6. Integral knife disconnection of unprotected terminal where available.

7. Intrinsically-safe where required; parallel-type on transmitter head or as close as possible on conduit, SurgeTrab by Phoenix Contact or equal by Weidmuller or Omega.

C. Manufacturer:

1. Phoenix Contact

a. 4-20mA (non-I/S): TermiTrab Complete (TTC), PlugTrab IQ (PT-IQ)

b. Discrete I/O (24Vdc): TermiTrab Complete (TTC), PlugTrab (PT-IQ)

2. Equal by Weidmuller

3. Equal by Citel

4. Or Equal

2.9 SURGE PROTECTIVE DEVICE (AC SIGNAL)

A. Provide SPD for all signal wires that extend outside the building/structure/enclosure where the panel is located.

B. Requirements

1. Conform with IEC/EN 61643-21.

2. Visual status indicator with option for remote monitoring.

C. Manufacturer:

1. Phoenix Contact

a. Discrete I/O (120Vac): TermiTrab TTC-6-MOV-C-120AC-UT-I

2. Equal by Weidmuller

3. Equal by Citel

4. Or equal

2.10 DC POWER SUPPLY

A. Switching type DC power supply.

B. Input: As indicated or as required for application

C. Output: 24Vdc (nominal). Nominal values of Wattage and Current indicated in the Drawings or as required for application. Output shall be adjustable between 24 and 28VDC. Negative terminal of output shall be grounded.

D. Power supply shall deliver 25% additional current continuously and deliver 150% of rated current for up to 5 seconds.

E. Overload Handling: Fold-Forward (Current rises, voltage drops to maintain constant power during overload up to max peak current)

F. Manufacturer

1. Phoenix Contact: Quint SFB

2. Puls: QT series

3. Or equal

2.11 PANEL ACCESSORIES

A. Provide plastic wire duct/wireway with snap-on cover mounted to the backplate. Wire duct shall be rated for high temperature and sized to provide a minimum of 30% spare fill capacity and arranged to allow ease of wiring. Manufacturers: Panduit (Type F), Iboco, or equal.

B. Provide documentation pocket mounted to inside of panel door to hold panel drawings.

C. Label all devices, components, and terminal strips. Labels shall not be affixed to devices or components, but rather to the back panel on which the devices and components are mounted. Provide engraved tags or equal.

2.12 FABRICATION

A. All electrical panels shall have a short circuit current rating (SCCR) and/or available interrupting current (AIC) rating as specified in 16050.

B. Provide 10% spare I/O capacity wired to terminal blocks.

C. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

D. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

E. Label all devices, components, and terminal strips. Labels shall not be affixed to devices or components, but rather to the back panel on which the devices and components are mounted. Provide lamicoid tags or equal.

F. Wire all internal panel devices that require field wiring connections to a field wiring terminal strip.

G. Fabricate in accordance with National Electric Code, Article 409 and UL 508A.

H. Provide wire markers on each end of each conductor as specified in 16075.

I. Control Cabinets shall be large enough such that there is a minimum clear space of 3 inches on the sides or 4 inches on the bottom for access while connecting or servicing field wiring. Clear space need only be provided on either the side or bottom of the enclosure adjacent to the field wiring terminal strip. If there are terminal strips on both the side and bottom, clear space shall be provided to each terminal strip.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cabinets and enclosures plumb; anchor securely to structural supports with materials and methods in accordance with Section 16070.

B. Neatly train and lace field wiring and terminate all field wiring on terminal blocks.

C. Clean debris from inside of enclosures and control panels.

D. Clean outside of enclosures and control panels.

E. Repair scratches per manufacturers recommendations.

F. Dented enclosures and control panels shall be replaced.

END OF SECTION

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SECTION 16138

DUCT BANKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Installation of duct banks

B. Related Sections

1. Section 02315 - Excavation, Backfilling and Compaction
2. Section 03100 – Concrete Forms and Accessories
3. Section 03200 – Concrete Reinforcement
4. Section 03300 - Cast-In-Place Concrete

1.2 REFERENCES

A. AASHTO - Standard Specification for Highway Bridges

B. ANSI/NEMA FB1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

C. ANSI/SCTE 77-2007 - Specification for Underground Enclosure Integrity

1.3 SUBMITTALS

A. Manufacturer’s shop drawings

B. Project data

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 5 years documented experience.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 DELIVERY, STORAGE AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Duct bank routing is shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.

PART 2 PRODUCTS

2.1 ACCESSORIES

A. Duct Bank Spacers

1. Type: Nonmetallic, interlocking, for multiple conduit sizes.

2. Suitable for all types of conduit.

3. Manufacturers

a. Underground Device, Inc.

b. Carlon.

PART 3 EXECUTION

3.1 DUCT BANK INSTALLATION

A. Install duct in accordance with manufacturer's instructions.

B. Install duct to locate top of duct bank at depths as indicated on drawings (or at 36 inches below grade depths not indicated on drawings).

C. Install duct with minimum slope of 1.5 inches per 100 feet. Slope duct away from building entrances.

D. Cut duct square using saw or pipe cutter; de-burr cut ends.

E. Insert duct to shoulder of fittings; fasten securely.

F. Join nonmetallic duct using adhesive as recommended by manufacturer.

G. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

H. Install no more than equivalent of three 90 degree bends between pull points.

I. Provide suitable fittings to accommodate expansion and deflection where required.

J. Stagger duct joints vertically in concrete encasement 6 inches minimum.

K. Use suitable separators and chairs installed not greater than 4 feet on centers.

L. Separate conduits by at least 7.5 inches center-to-center in duct banks.

M. Band ducts together before placing concrete.

N. Securely anchor duct to prevent movement during concrete placement.

O. For non-concrete encased conduits, backfill the trench with sand borrow for the full width of the trench (at least 3 inches around sides and bottom of conduit) and extend the sand borrow 12 inches over the conduit. For concrete encased ductbanks, provide the following:

1. Poured in place concrete in accordance with the provisions of Sections 03100, 03200, and 03300.

2. Minimum 3 inch concrete cover at bottom, top, and sides of duct bank.

3. Two No. 4 steel reinforcing bars in top of bank under paved areas.

4. Connect to existing concrete encasement using dowels.

P. Excavation, backfill and compaction of trenches shall be performed under provisions of Section 02315.

Q. Provide suitable pull string in each empty duct except sleeves and nipples.

R. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

3.2 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of exact routing of duct bank.

B. Accurately record actual locations of each manhole and each handhole.

END OF SECTION

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SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Wall switches
2. Receptacles
3. Cover plates

B. Related Sections

1. Section 16136 - Boxes

1.2 SUBMITTALS

A. Product Data: Provide catalog sheets for wiring devices.

PART 2 PRODUCTS

2.1 WALL SWITCHES

A. Single Pole Switch - 20 Amp, 120/277 VOLT

1. Specification grade, standard toggle, brown handle
   a. Hubbell - Model 1221
   b. Equal by Pass & Seymour
   c. Equal by Bryant
   d. or equal

2.2 RECEPTACLES

A. Duplex 20A, 125 V, 1 phase, 3 wire, grounding

1. Specification grade, nylon, brown, straight blade
   a. Hubbell - Model 5362
   b. Equal by Pass & Seymour
   c. Equal by Bryant
   d. or equal

B. GFCI Receptacle - 20 A, 120 V duplex

1. Specification grade, nylon, brown, straight blade
   a. Hubbell - Model GFR5362
   b. Equal by Pass & Seymour

c. Equal by Bryant

d. or equal

2.3 COVER PLATES

A. Decorative Cover Plate - smooth stainless steel

1. Hubbell - Catalog Number

a. One gang duplex receptacle - S8

b. One gang GFCI duplex receptacle - S26

c. One gang toggle switch - S1

d. Two gang toggle switch - S2

e. Blank, one gang - S13

f. Switch, duplex receptacle - S18

2. Equal by Pass & Seymour

3. Equal by Bryant

4. or equal

B. Weatherproof Cover Plate – copper free aluminum, for general use snap switches in cast device boxes, including gasket

1. Crouse - Hinds – Cat. No. DS181

2. Equal by Killark

3. Equal by Appleton

4. or equal

C. Weatherproof Cover – Weatherproof while in use type for outdoor and wet locations.

1. Sealing gasket and stainless steel mounting screws, for duplex GFCI receptacle, vertical orientation

2. Cast metal base and cast metal cover.

a. ABB Red Dot Installation Products

b. Equal by Hubbell, Inc.

c. Equal by Pass & Seymour

d. Equal by Bryant

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on bottom.

E. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

F. Connect wiring devices by wrapping conductor around screw terminal.

G. Install corrosion resistant, weatherproof cover plates on all devices located outside, in pump chambers, garages, chemical areas, areas subject to water spray or as indicated on drawings. Cover plate material and coating shall match the box unless otherwise specified.

H. Install decorative stainless steel plates on switches and receptacles in dry areas.

I. Install weatherproof while in use type covers for receptacles located outdoors.

J. Use stainless steel screws and hardware for mounting, device plates, fixtures, etc. in wet, damp, hazardous and corrosive areas.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 16136 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor unless otherwise noted on plans.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 16210

ELECTRIC SERVICE ENTRANCE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Arrangement with Utility Company for permanent electric services.

2. Payment by the Contractor for all Utility Company charges for the permanent electric services.

3. Underground service entrance.

1.2 SYSTEM DESCRIPTION

A. System Voltage:

1. 277/480 volts, three phase, 4-wire

1.3 QUALITY ASSURANCE

A. Utility Company: Eversource

B. Utility Engineer: Gregory Lucibello, Telephone: 860-871-3442

C. Install service entrance in accordance with Utility Company's rules and regulations. Obtain Utility Company approvals prior to ordering any materials or starting any construction. Inform Engineer if Utility Company requires significant changes.

PART 2 PRODUCTS

2.1 SERVICE EQUIPMENT

A. Main Service Disconnect

1. 125 amp circuit breaker with adjustable long time, short time & instantaneous (LSI) trip settings

B. Utility Meter

1. Meter socket, furnish in accordance with Utility Company requirements.

2. Meter, furnished by the Utility Company.

C. Underground Service

1. Riser pole, furnished by Utility Company.

2. Overhead service cable, cable terminations and installation, provided by Utility Company.

3. Underground secondary service cable, cable terminations and cable pulling, provide in accordance with Utility Company requirements.

4. Service conduit, 4 inch Schedule 40 PVC for service cables and one 4 inch Schedule 40 PVC spare conduit with pull string, furnish in accordance with Utility Company requirements. Provide caps for spare conduit. Provide pull

strings where required. Provide concrete encasement for conduits run beneath pavement.

5. Rigid steel sweep on riser pole and below main circuit breaker, provide in accordance with Utility Company requirements.

6. Provide conduit expansion fitting below main circuit breaker.

D. Surge Protection Device (SPD)

1. Provide surge protection in accordance with Section 16490.

PART 3 EXECUTION

3.1 INSTALLATION

A. Make arrangements with Utility Company to obtain permanent electric service.

B. Coordinate installation of trench for electric service in accordance with Utility Company requirements. Coordinate backfilling of trench, in accordance with Utility Company requirements, after cables have been installed.

C. Install electric service conduits (with pull strings where required) and cables, in accordance with Utility Company requirements.

D. Install rigid steel sweeps and riser on Utility riser pole in accordance with Utility requirements.

E. Install rigid steel sweeps and conduit expansion fitting below main circuit breaker accordance with Utility requirements.

F. Install meter socket in accordance with Utility Company requirements.

END OF SECTION

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SECTION 16220

AC MOTORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Single Phase Capacitor Start Motors

2. Three Phase Squirrel Cage Motors

1.2 REFERENCES

A. ANSI/NEMA MG 1 - Motors and Generators.

B. ANSI/NEMA MG 3 – Sound Level Prediction for Installed Rotating Electrical Machines

C. ANSI/NFPA 70 - National Electrical Code.

D. ANSI/IEEE 112 – IEEE Standard for Polyphase Induction Motors and Generators

1.3 SUBMITTALS

A. Factory test reports for all 3-phase motors 20 hp and larger. Test report shall include:

1. No load current

2. Full load current

3. Breakdown torque

4. Locked rotor (starting) current

5. Locked rotor torque

6. Hi-potential test

B. Product data and manufacturer's installation instructions.

C. Operation and maintenance data.

1. Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.4 QUALITY ASSURANCE

A. Qualifications - Manufacturer/Company specializing in manufacture of electric motors for industrial use, and their accessories, with minimum 3 years documented product development, testing, and manufacturing experience.

B. Regulatory Requirements

1. Conform to National Electrical Code

2. Conform to local energy code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General Electric Co., Extra Severe Duty (XSD), energy saver design.

B. Reliance, Model XE-XT.

C. U.S. Motors - Corro-Duty, premium efficiency.

D. Baldor - Super E, hostile environment.

E. or equal.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Motors - Design for continuous operation in 40 degrees C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, Service Factor, and motor enclosure type.

B. Efficiency: Motors shall be premium efficiency type, as defined in NEMA MG 1

C. Classified Locations – Motors installed within classified locations shall be designed to provide the appropriate NFPA 70 Class and Division protection requirements. Explosion-proof motors shall be UL approved and labeled for hazard classification, with over temperature protection.

D. Visible Nameplate - Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, Service Factor, Power Factor, efficiency, AFBMA bearing numbers, manufacture date. Stainless steel nameplate attached with stainless steel pins.

E. Electrical Connection - Oversized, diagonally split, cast-iron junction boxes with gaskets. Box provided with threaded conduit connection. Box shall be adjustable to all four mounting positions.

F. Enclosures – Enclosures shall be TEFC (Totally Enclosed Fan Cooled). Fans for TEFC motors shall be non-sparking bronze-alloy or reinforced plastic.

G. Motors less than 250 watts and intended for intermittent service need not conform to these specifications.

2.3 SINGLE PHASE CAPACITOR START MOTORS

A. Starting Torque - Three times full load torque.

B. Starting Current - Less than five times full load current.

C. Pull-up Torque - Up to 350 percent of full load torque.

D. Breakdown Torque - Approximately 250 percent of full load torque.

E. Motors - Capacitor in series with starting winding; capacitor-start/capacitor-run motors shall have two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Totally enclosed Motors - Class F insulation, 1.25 Service Factor, regreasable ball bearing.

PART 3 EXECUTION

3.1 TESTING

A. Test motors in accordance with 16080.

3.2 NEMA MOTOR SERVICE FACTORS

HP	3600 RPM	1800 RPM	1200 RPM	900 RPM
1/6 - 1/3	1.35	1.35	1.35	1.35
½	1.25	1.25	1.25	1.15
¾	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15
1½ -500	1.15	1.15	1.15	1.15

END OF SECTION

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SECTION 16230

PACKAGED ENGINE GENERATOR SYSTEMS (DIESEL FUEL)

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the following items from a single supplier:

1. Engine Generator Set.

2. Related Accessories as specified

B. Related Requirements

1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.

2. Any exceptions to the published specifications shall be subject to the approval of the engineer and submitted minimum 10 days prior to the closing of the bid with a line by line summary description of all the items of compliance, any items that have been are omitted or have been taken exception to, and a complete description of all deviations.

3. All equipment shall be new and of current production by the power system manufacturer of generators, transfer switches, and paralleling switchgear. The manufacturer shall be a supplier of a complete and coordinated system. There will be single-source responsibility for warranty, parts, and service through a factory-authorized representative with factory-trained technicians.

1.2 SCOPE

A. The work under this Section shall include Furnish and install a new diesel engine driven generator set, with physical capacities and controls, as specified herein and shown on drawings. The engine generator set shall be interior mounted.

B. See Part 2 for engine set size, voltage and performance characteristics.

C. Engine generator system to provide power in accordance with NEC 702.

D. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

E. The specifications and drawings describe the minimum requirements that must be met by Contractor for the installation of all work as shown on the drawings and as specified hereunder.

F. The equal manufacturers listed in this specification shall provide a unit that meet or exceed all capacities, rating and performance items listed in this specification. This may require the equal manufacturer to provide units that are larger in size, rating and capacity or require the equal manufacturer to provide a custom unit.

1.3 REFERENCES

A. Examine all drawings and criteria sheets and all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

B. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design Architect and Engineers plans and specifications, with all applicable codes, rules and standards, including but not limited to:

1. ANSI/NEMA 250 - Enclosures for Electrical Equipment 1000 Volts Maximum.
2. ANSI/NEMA AB1 - Molded Case Circuit Breakers and Enclosures
3. ANSI/NEMA KS 1 - Enclosed Switches
4. ANSI/NEMA MG1 - Motors and Generators, including all applicable reference standards.
5. NFPA 20 – Installation of Stationary Pumps
6. NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
7. NFPA 70 - National Electric Code (with state and local amendments)
8. NFPA 704 – Standard for Identification of the Hazards of Materials for Emergency Response
9. UL 489-80 - Molded Case Circuit Breakers
10. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
11. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
12. IEC8528 part 4, Control Systems for Generator Sets.
13. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
14. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
15. NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
16. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

1.4 RELATED SPECIFIED WORK

A. The General Documents, as listed on the Table of Contents and applicable parts of Division 1 and General Requirements shall be included in and made part of this Section.

B. The following referenced Division 16 sections are listed as a minimum of additional requirements and/or work not included in this Section which may be required to be performed under other designated Sections:

1. Section 16050: – Basic Electrical Requirements
2. Section 16060: Grounding and Bonding
3. Section 16070: Electrical Hangers and Supports
4. Section 16075: Electrical Identification
5. Section 16080: Electrical Testing
6. Section 16120: Conductors and Cables
7. Section 16131: Conduit
8. Section 16136: Boxes
9. Section 16415: Automatic Transfer Switch

1.5 SUBMITTALS

A. Prepare and submit complete shop drawings of panelboards required on this project to Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer, for approval. Samples shall be in size and form requested by the Engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the Engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless they have submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Do not order materials or begin installation until the Engineer's approval of submittals has been obtained.

G. Action Submittals

1. Product Data

a. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection

diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

2. Complete product description and specifications
3. Complete performance test data
4. Complete preparation and manufacturer's installation instructions
5. Product data showing nameplate data, dimensions, weights, ratings, interconnection points
6. Internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger
7. Exhaust silencer and vibration isolators
8. Test data for MG1-16.50, 16.51 and 16.86.2
9. All other pertinent technical data required for complete product and product use information

H. Informational Submittal

1. Certificates
   a. The generator set shall be listed to UL 2200 or submitted to an independent third-party certification process to verify compliance as installed.
   b. The generator set shall be IBC Certified as meeting the required maximum seismic design acceleration level per the International Building Code for the specific job site. The generator shall be analyzed or shake tested by a third party, accompanied by a Certificate of Compliance, and include a seismic label on the generator set (per Section 1702 of the IBC Code). Seismic certified generators shall be installed per the specific seismic instructions provided by the manufacturer.
2. Test and Evaluation Reports
3. Manufacturer’s Instruction
4. Source Quality Control Submittals
5. Field or Site Quality Control
6. Manufacturer’s Report
7. Special Procedure Submittal
8. Qualification Statement
9. EPA Exhaust Emissions Compliance Statement
10. Exhaust Emissions Data Sheet
11. Custom color samples for owner selection.

I. Closeout Submittal

1. Maintenance Contracts

2. Operation and Maintenance Data

3. Bonds

4. Warranty Documentation

5. Record Documentation

6. Software

J. Maintenance Material Submittals

1. Provide two (2) copies of the following documents and manuals for the engine, the alternator, and the generator set:

a. Operation Manuals

b. Parts Catalogs

c. Service Manuals

d. Installation Manuals

e. Wiring Diagrams

f. NFPA-110 Startup, Test Procedure and reports.

1.6 QUALITY ASSURANCE

A. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.

B. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.

C. Supplier - Authorized distributor of engine generator manufacturer with service facilities within 100 miles.

D. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site.

B. Store and protect products.

C. Accept packaged engine generator set and accessories on site in crates and verify damage.

D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic

E. The electrical contractor shall provide the diesel fuel necessary for the job site acceptance test to take place. After the job site acceptance test is complete the electrical contractor shall fill the generator base tank to 100% full level.

1.8 FIELD OR SITE CONDITIONS

A. Ambient Conditions

1. Engine- generator set shall operate in the following conditions without any damage to the unit or its loads.

2. Ambient Temperature: 77 °F

3. Altitude : 500 ft

4. Relative Humidity: 95%

1.9 WARRANTY

A. In addition to the specific guarantee requirements of the General Conditions, the Contractor shall obtain in the Owner's name the standard written manufacturer's warranty of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

B. Provide a two-year manufacturer’s extended comprehensive warranty and maintenance contract for the generator system.

1. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A two-year service agreement shall be included and shall include a minimum of two calls per year as follows: one annual service including all labor and materials to provide manufacturer’s recommended annual service and one visual inspection to include: system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and controls as required, and certification in the owner's maintenance log of repairs made and function tests performed on all system.

1.10 COORDINATION

A. The work of this Section shall be coordinated with other work of the Contractor. To ensure system compatibility and single source responsibility, the generator set supplier shall also provide the automatic transfer switch(es) as part of this package.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. The engine generator set shall be as manufactured by Cummins Model Number C60D6 with alternator CA125-L14 or equal product as manufactured by Kohler or Caterpillar or equal.

B. The equal manufacturers listed above shall provide a unit that meet or exceed all capacities, rating and performance items listed in this specification. This may require the equal manufacturer to provide units that are larger in size, rating and capacity or require the equal manufacturer to provide a custom unit.

C. The engine generator set supplier shall submit documentation to prove that service and parts are available 24 hours/day, 7 days/week, 365 days/year. Service time, after receipt of notification of problem or failure, shall not exceed four (4) hours for response and arrival of technical service representative at the jobsite. Generator sets shall be furnished by the authorized distributors of the equipment who have assigned territory in the area in which the generator sets are to be installed. Equipment furnished by others not having a defined assigned territory will not be considered.

D. To ensure system compatibility, the automatic transfer switches shall be furnished by the emergency generator set supplier.

2.2 WORK BY OTHER DIVISIONS

A. Generator housekeeping concrete pad.

B. Fuel oil system

C. Engine Exhaust System

D. Generator room air intake and exhaust systems

2.3 EQUIPMENT

A. The engine generator set shall be minimum 60 kW, 75 kVA, 225 Start kVA, 0.8 power factor. The voltage output shall be 480 volts, 3 phase, 4 wire, 60 Hz at generator speed of 1800 RPM ambient temperature between -20 and 100 degrees F, the ratings shall be with water pump attached. All units shall be capable of picking up their rated capacity in one (1) step and provide a transition time, from instant failure of the normal power source to the generator source, of ten (10) seconds or less. The rating shall conform with BS649:1958 and DIN "A" 6270 and each diesel generator shall be provided as specified herein. All generators shall comply with NFPA-110.

B. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 77 °F and a maximum elevation of 500 ft above sea level. The standby rating shall be available for the duration of the outage.

C. The engine shall operate satisfactorily on a commercial grade of No. 2 ultra low sulfur diesel fuel oil and shall not require a premium fuel such as kerosene. Ratings shall be as listed in the 1996 Diesel and Gas Turbine Worldwide Catalog.

D. If after coolers are required, the only source of water shall be engine jacket water.

E. The diesel engine shall be of the vertical, maximum 16-cylinder and minimum 4-cylinder, 4-cycle, fuel injection diesel type, with moving parts housed. Two-cycle engines will be unacceptable and will not be considered. The maximum speed of the engine in the service anticipated shall not exceed 1,800 rpm. The fuel injection system for the engine shall be of the low pressure type. The cylinder liners of the engine shall be of the wet type and removable. The complete diesel engine generator unit shall be free from critical and torsional vibration within the operating speed range. The engine shall be furnished complete with the following accessories:

1. Electronic isochronous governor capable of 0.25% steady-state frequency regulation

2. 24-volt positive-engagement solenoid shift-starting motor

3. 45-ampere automatic battery charging alternator with a solid-state voltage regulation

4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain

5. Dry-type replaceable air cleaner elements for normal applications

6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel a minimum 6 feet

7. The turbocharged engine shall be fueled by diesel

8. The engine shall have be liquid-cooled

F. The engine shall be EPA certified from the factory

G. The engine and enclosure shall be seismic certified from the factory

H. The generator must accept rated load in one-step.

I. The engine manufacturer shall provide the necessary lube oil for the crankcase and antifreeze for the cooling system to provide protection to -20°F. Test kit shall be provided to determine sulfate or phosphate levels in the system. Oil and coolant drains with lockable valves shall also be provided.

2.4 COOLING SYSTEM

A. The engine shall be liquid-cooled by a closed loop, unit mounted radiator rated to operate the generator set at full load at an ambient temperature of 50 degrees C (122 degrees F). The radiator fan and other rotating engine parts shall be guarded against accidental contact.

B. When the generator is installed interior to the building the following CFM (cubic feet per minute) shall be used for determining louver opening.

1. Radiator Air Flow (cfm): 3290 cfm

2. Combustion Air Flow (cfm): 199 cfm

C. The CFMs listed above are based on the Cummins Generator listed herein and not the equal manufacturers. If one of the equal manufactures is selected, the contractor shall be responsible for resizing the louvers and dampers to provide sufficient air flow for the proposed equal generator. All costs associated with and resulting from the redesign shall be paid for by the contractor.

D. Heavy Duty Air Cleaner

1. The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.

E. Battery

1. Each genset requires batteries which must meet the engine manufactures' specifications for the ambient conditions specified in Part 1 Project Conditions and shall comply with the NFPA requirements for engine cranking cycles. Each battery shall be rated according to SAE Standards J-537 with a minimum cold cranking amp of 950 amps and a minimum reserve capacity of 185 Minutes at 80F. The battery plates shall be constructed of a Calcium-Lead alloy to provide long waterless operation and extended battery life. The battery elements must be anchor-locked with full-frame grids and tight-packed commercial plates to resist the effects of vibration. The battery must contain a handle to aid in lifting and the case must be constructed of polypropylene to resist breakage and extend service life. Removable cell covers shall be provided to allow for checking of electrolyte specific gravity.

2. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.

2.5 VIBRATION ISOLATION

A. The generator set shall be IBC Certified as meeting the required maximum seismic design acceleration level per the currently adopted International Building Code for the specific job site. The generator shall be analyzed or shake tested by a third party, accompanied by a Certificate of Compliance, and include a seismic label on the generator set (per Section 1702 of the IBC Code). Seismic certified generators shall be installed per the specific seismic instructions provided by the manufacturer.

2.6 ALTERNATOR

A. The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator. The Automatic Voltage Regulator (AVR) shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.

B. The alternator shall have a maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

C. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

D. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying at least 225 LRKVA for starting motor loads at 90% sustained voltage, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. The generator set shall be prototype tested to optimize and determine performance as a generator set system.

2.7 ENGINE MOUNTED CONTROL PANEL

A. Controller

1. The generator set controller shall be a microprocessor-based control system that will provide automatic starting, system monitoring, and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware, and software.

2. The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.

3. The control panel shall be the Power Command 2100 by Cummins, Decision-Maker 550 by Kohler or equal.

B. Codes and Standards

1. The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.

2. The controller shall meet NFPA 99 and NEC requirements.

3. The controller shall be UL 508 listed.

C. Applicability

1. The controller shall be a standard offering in the manufacturer's controller product line.

2. The controller shall support 12-volt and 24volt starting systems.

3. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.

4. The controller shall be mounted on the generator.

D. Hardware Requirements

1. Control Panel shall include:

a. The control shall have a run-off/reset-auto three-position selector switch

b. Emergency Stop Switch. The controller mounted, latch type remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.

c. Five indicating lights (LED):

1) System Ready - green

2) Not in Auto - yellow

3) Programming Mode - yellow

4) System Warning – yellow

5) System Shutdown – red

d. Digital Display. The display shall be viewable in all light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. The 16-button keypad gives the user information access and local programming capability.

e. Sixteen-position snap action environmentally sealed tactile-feel membrane keypad for menu selection and data entry.

f. For ease of use, an operating guide shall be printed on the controller faceplate.

g. Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.

h. Lamp Test Button. When this button is depressed, it shall test all controller lamps.

i. Alarm Off. This button will silence the alarm horn when the unit is AUTO.

j. Panel lights shall be supplied as standard.

E. Control Functional Requirements

1. The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:

a. Field-programmable time delay for engine start. Adjustment range 0-5 minutes in 1 second increments.

b. Field-programmable time delay engine cool down. Adjustment range 0-10 minutes in 1 second increments.

c. Capability to start and run at user-adjustable idle speed during warm-up for a selectable time period (0-10 minutes), until engine reaches preprogrammed temperature, or as supported by ECM-equipped engine.

d. The idle function including engine cooldown at idle speed.

e. Real-time clock and calendar for time stamping of events.

f. Output with adjustable timer for an ether injection starting system. Adjustment range, 0-10 seconds

g. Programmable cyclic cranking that provides up to 30 seconds of programmable cyclic cranking and up to 60 seconds rest with up to 6 cycles.

h. The capability to reduce controller current battery draw, for applications where no continuous battery charging is available. The controller vacuum fluorescent display should turn off automatically after the controller is inactive for 5 minutes.

i. Control logic with alternator protection for overload and short circuit matched to each individual alternator and duty cycle.

j. Control logic with RMS digital voltage regulation. The system shall have integral microprocessor based voltage regulator system that provides +/- 0.25% voltage regulation no-load to full load with three phase sensing. A separate voltage regulator is not acceptable. The digital voltage regulator shall be applicable to single- or three-phase systems. The system shall be prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 20% adjustable of nominal voltage.

k. The capability to exercise the generator set by programming a running time into the controller. This feature shall also be programmable through the PC software if provided.

l. Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.

m. Control function shall include output voltage adjustment.

n. Switch function selection to override normal fault shutdowns, except emergency stop and over speed shutdowns.

o. The control shall detect the following conditions and display on control panel:

1) Customer programmed digital auxiliary input ON (any of the inputs available)

2) Customer programmed analog auxiliary input out of bounds (any of inputs for ECM equipped engines and inputs for non ECM engines)

3) Emergency stop

4) High coolant temperature

5) High oil temperature

6) Controller internal fault

7) Locked rotor - fail to rotate

8) Low coolant level

9) Low oil pressure

10) Master switch error

11) NFPA common alarm

12) Overcrank

13) Overspeed with user-adjustable level, range 60-70 Hz. Field set to 61 Hz.

14) Overvoltage with user adjustable level, range 105% to 135%. Field set to 115%.

15) Overfrequency with user adjustable level, range 102% to 140%. Field set to 110%.

16) Underfrequency with user adjustable level, range 80% to 90%. Field set to 90%.

17) Undervoltage with user adjustable level, range 70% to 95%. Field set to 85%.

18) Coolant temperature signal loss

19) Oil pressure gauge signal loss

p. Conditions resulting in generator warning (generator will continue to operate):

1) Battery charger failure

2) Customer programmed digital auxiliary input on (any of the 21 inputs available)

3) Customer programmed analog auxiliary input on (any of the inputs available on ECM engines and inputs for non ECM engines)

4) Power system supplying load

5) Ground fault detected – any feeder circuit breaker listed in sections below with ground fault trip or ground fault alarm shall be factory wired to the controller to signal which devices has detected a ground fault.

6) High battery voltage - Level shall be user adjustable. (Range 29-33 volts for 24-volt systems.)

7) High coolant temperature

8) Loss of AC sensing

9) Underfrequency

10) Low battery voltage - level shall be user adjustable (Range 20-25 volts for 24-volt systems.)

11) Low coolant temperature

12) Low fuel level or pressure

13) Low oil pressure

14) NFPA common alarms

15) Overcurrent

16) Speed sensor fault

17) Weak battery

18) Alternator protection activated

F. Control Monitoring Requirements

1. The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:

a. All monitored functions must be viewable on the control panel display.

b. The following generator set functions shall be monitored:

1) All output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy

2) All single phase and three phase currents, 0.25% accuracy

3) Output frequency, 0.25% accuracy

4) Power factor by phase with leading/lagging indication

5) Total instantaneous kilowatt loading and kilowatts per phase

6) kVARS total and per phase

7) kVA total and per phase

8) kW hours

9) A display of percent generator set duty level (actual kW loading divided by the kW rating)

c. Engine parameters listed below shall be monitored:

1) Coolant temperature both in English and metric units

2) Oil pressure in English and metric units

3) Battery voltage

4) RPM

5) Lube oil temperature

6) Lube oil level

7) Crankcase pressure

8) Coolant level

9) Coolant pressure

10) Fuel pressure

11) Fuel temperature

12) Fuel rate

13) Fuel used during the last run

14) Ambient temperature

d. Operational records shall be stored in the control beginning at system startup.

1) Run time hours

2) Run time loaded hours

3) Run time unloaded hours

4) Number of starts

5) Factory test date

6) Last run data including date, duration, and whether loaded or unloaded

7) Run time kilowatt hours

e. The following operational records shall be a resettable for maintenance purposes:

1) Run time hours

2) Run time loaded hours

3) Run time unloaded hours

4) Run time kilowatt hours

5) Days of operation

6) Number of starts

7) Start date after reset

f. The controller shall store the last one hundred generator set system events with date and time of the event.

g. For maintenance and service purposes, the controller shall store and display on demand the following information:

1) Manufacturer's model and serial number

2) Battery voltage

3) Generator set kilowatt rating

4) Rated current

5) System voltage

6) System frequency

7) Number of phases

8) Rated current

9) System voltage

10) System frequency

11) Number of phases

G. Inputs and Outputs

1. Inputs

a. There shall be at least 16 dry contact inputs that can be user-configured to shut down the generator set or provide a warning.

b. There shall be at least 4 user-programmable analog inputs for monitoring and control.

c. Each analog input can accept 0-5 volt analog signals

d. Each input shall include range settings for 2 warnings and 2 shutdowns.

e. All values shall be on the control panel display.

f. Shall be user-assigned.

g. Input for an external ground fault detector. Digital display shall show "ground fault" upon detection of a ground fault.

h. Reset of system faults.

i. Remote two-wire start.

j. Remote emergency stop.

k. Idle mode enable.

2. Outputs

a. All NFPA 110 Level 1 outputs shall be available.

b. Thirty outputs shall be available for interfacing to other equipment

1) All outputs shall be user-configurable from a list of 25 functions and faults

2) These outputs shall drive optional dry contacts.

c. A programmable user-defined common fault output with over 40 selections shall be available.

d. The following indications shall be programmed and wired to terminal strip in the control panel for monitoring by the Telemetry System.

1) Emergency generator "ON"

2) Emergency generator "start failure"

3) Emergency generator "common pre-alarm"

4) Emergency generator "common shutdown"

5) Fuel tank rupture

6) Low fuel

2.8 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. The generator shall be provided with a factory installed, 80% rated line circuit breaker rated at 125 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.

B. The generator shall be provided with a 2nd factory installed, 80% rated line circuit breaker rated at 125 amperes that is UL489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC. This breaker is for connection of a portable load bank.

C. The first circuit breaker shall incorporate an electronic trip device with the following characteristics:

1. Adjustable long time pickup and long time delay

2. Adjustable short time pickup and delay

3. Adjustable Instantaneous

4. Shunt trip operator - The shunt trip device shall be connected to trip the generator breaker when the generator-set is shut down by other protective devices.

D. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections.

E. Barriers to provide segregation of wiring from an emergency source to emergency loads from all other wiring and equipment, if required by the NEC, shall be provided.

2.9 EXHAUST SYSTEM

A. A minimum Critical grade exhaust silencer, fully the equal of Maxim Model M51, with condensate drains and valves of the proper size for use with the engine, shall be furnished. It shall have a bottom inlet and outlet oriented for the installed system. Flexible, full length stainless steel connector shall be furnished. The generator set manufacturer shall furnish connectors with all appropriate fittings, flanges, etc., as required.

B. The exhaust silencer shall be turned over to the General Contractor for installation and insulation.

2.10 ACCESSORIES

A. The generator set shall be supplied with a 10-ampere automatic float/equalize battery charger capable of charging both lead-acid and ni-cad type batteries, with the following features:

1. Automatic 3-stage float to equalization charge
2. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations
3. Battery charging current Ammeter and battery voltage voltmeter with 5% full-scale accuracy
4. LED lamp for power ON indication
5. Current limited during engine cranking, short circuit, and reverse polarity conditions
6. Temperature compensated for ambient temperatures for -40°C to 60°C
7. UL 1012 Listed
8. Battery charger shall be factory installed.

B. Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be factory installed.

C. The generator set shall be supplied with a common failure relay to provide means of signaling fault and/or shutdown conditions.

1. The common failure relay shall remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and over speed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
2. The relay contacts shall be gold flashed to allow use of low current draw devices (100ma @ 28VDC min.).
3. Once energized the relay shall remain latched until the system is reset by the main controller switch.

D. The generator set shall be provided with a run relay which shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is

running. The run relay dry contacts can be used for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

E. Firomatic Thermal Switch - Provide a firomatic thermal switch for mounting above the generator (not shown on drawings). The firomatic thermal switch mounted over the generator shall be wired in series with the fuel solenoid valve on the engine so that upon tripping, it will stop the flow of fuel directly at the generator. The firomatic thermal switch shall be installed and wired according to the generator manufacturer's directives and all applicable codes.

F. Wall Thimble – Supply a stainless steel ventilated wall thimble for a combustible wall conforming to NFPA 37. Size shall be equal to generator exhaust piping. The wall thimble shall have a stainless steel weather hood and an insect screen.

G. Remote Emergency Stop for Indoor Generator - a break-glass style switch (protected from accidentally operation) shall be furnished lose for remote mounting outside the door of the building. Mount the switch (coordinate exact location with Engineer) on the exterior wall and provide 2#14 wires and a #14 ground wire in conduit (3/4 inch minimum) from the switch to the generator control panel.

2.11 GENERATOR SYSTEM TESTING

A. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

B. Design Prototype Tests. Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:

1. Maximum power (kW)
2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
4. Governor speed regulation under steady-state and transient conditions.
5. Voltage regulation and generator transient response.
6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
7. Three-phase short circuit tests.
8. Alternator cooling air flow.
9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
10. Endurance testing.

C. Final Production Tests. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-step load pickup
2. Safety shutdown device testing

3. Rated Power @ 0.8 PF

4. Maximum power

5. Upon request, a witness test, or a certified test record sent prior to shipment.

D. See Part 3 for job site acceptance.

PART 3 EXECUTION

3.1 JOBSITE ACCEPTANCE TESTS

A. The electrical contractor shall provide the diesel fuel necessary for the job site acceptance test to take place. After the job site acceptance test is complete the electrical contractor shall fill the generator base tank to 100% full level.

B. Jobsite testing shall be conducted as described below after start-up is complete. Start-up shall include battery installation, fuel system priming, and a general inspection of the exhaust and ventilation systems to ensure proper installation and operation. The generator set shall then be started and observations shall be made by a factory trained technician as to proper operation of the engine, generator, generator controls, and all external engine generator support systems. All safety shutdowns and prealarm devices shall be checked for proper operation of the circuit and corresponding indicating lights on the control panel and at the remote annunciator panel, in the presence of the Owner and the Electrical Engineer. Phase rotation shall be checked.

C. After start-up is complete, load testing shall be conducted in strict accordance with the latest edition of NFPA 110. The testing shall consist of an on-site installation test utilizing available connected load by initiating a normal power failure and a transfer to emergency of all automatic and/or manual transfer switches. The prime mover shall be in a cold start condition and the following shall be observed and recorded:

1. Time delay engine start.

2. Crank time until prime mover starts and runs.

3. Time required for prime mover to come up to operating speed.

4. Record voltage and frequency overshoot.

5. Time required to achieve steady state operation with all transfer switches transferred to the emergency position.

6. Record voltage, amperage and frequency.

7. Record prime mover oil pressure, water temperature and battery charge rate at five (5) minute intervals for the first fifteen (15) minutes, and at fifteen (15) minute intervals thereafter.

8. Continue building load test for two (2) hours and continue to record readings at fifteen (15) minute intervals. Additionally, observe and record load changes and the resultant effect on voltage and frequency.

D. After completion of the above test, allow the prime mover to cool for five (5) minutes. At this point, a test shall be conducted for two (2) hours at full station power utilizing available building load, supplemented with resistive load banks. Once the prime mover has been started and has reached rated voltage and frequency, apply full rated load in one (1) step. Record the data listed in on-site testing above for the first load acceptance

and every fifteen (15) minutes thereafter until the completion of the two (2) hour test period.

E. After tests are complete, provide the following additional tests and record the appropriate data:

1. Observe and record cyclic crank/overcrank lockout duration.

2. Observe and test all safety shutdown circuits specified.

F. After all testing is completed and accepted by the Owner, provide a detailed test record in six (6) sets including all recordings and test logs. Also, provide a letter on manufacturer's letterhead indicating that testing has been successfully completed and the emergency system is in first class operating condition.

G. Fuel for testing the generator shall be obtained from the main fuel tank. The fuel tank shall be filled by the Electrical Subcontractor using No. 2 diesel fuel oil before and after the load bank test.

H. If there is any sort of equipment failure during startup and testing and after all systems have past testing parameters and is complete and accepted, the Electrical Subcontractor shall arrange with the generator set supplier to drain, flush and refill the engine with a fresh supply of lubricating oil and filters.

I. See specification section 16080 for additional testing requirements.

3.2 OPERATION INSTRUCTION AND MAINTENANCE MANUAL

A. After completion of work and start-up of the equipment at the jobsite, deliver to the Electrical Contractor, the required copies of operating instruction, maintenance manuals and drawings presently full details for care and maintenance of each item of equipment furnished and/or installed under this Contract.

B. Each manual shall contain the operating and maintenance information and parts lists furnished by the manufacturer, for all equipment provided in the Contract. When necessary, provide supplemental drawing to show system operation and serving and maintenance points. For all electrical components, furnish wiring and connection diagrams. Manuals shall include instructions required to accomplish specified operation and functions. Data shall be neat, clean legible copies. Drawings shall be accordion folded. Non-applicable information shall not be included. Ten (10) sets of manuals shall be furnished to the Owner.

C. Shop drawings and wiring diagrams shall be furnished completely and up to date at the completion of start-up and system acceptance by the Owner. Drawings and wiring diagrams shall include any field modification or changes to reflect actual as-built conditions.

3.3 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

B. The Electrical Subcontractor shall provide three (3) copies of the manufacturer's representative's certification before final payment is made.

C. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.4 TRAINING

A. The Electrical Subcontractor shall provide a training session for up to 6 Owner's representatives for 1 normal workday at a jobsite location determined by the owner.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

C. The training program shall include the following:

1. Review of the project one-line drawings and schedules.

2. Review of the factory record shop drawings.

3. Review of all equipment in the electrical distribution system.

4. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.

5. Provide three ring binders to participants complete with copies of drawings and other course material covered.

END OF SECTION

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SECTION 16265

AC VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. AC variable frequency drives (VFDs or AFDs). Furnished under Section 11312.

1.2 REFERENCES

A. ANSI/NEMA ICS 3 - Industrial Systems

B. NEMA ICS 7.0 – Industrial Controls & Systems for AFDs

C. IEEE 519 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

1.3 SUBMITTALS

A. Shop drawings, product data and reports.

B. Project specific wiring diagrams.

C. Operation and Maintenance Data

1. Submit instruction manuals with recommended maintenance procedures and intervals, installation, operation and programming information.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store drive in a warm, dry, non-corrosive location in original shipping carton to prevent damage.

1.5 SPARE PARTS

A. One printed circuit board control card of each type furnished.

B. Six fuses of each type furnished.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Yaskawa V1000

B. Allen-Bradley: Powerflex 753

C. or equal

2.2 AC VARIABLE FREQUENCY DRIVE

A. The variable frequency AC drive shall convert 3 phase, 60 hertz input power to a variable AC frequency and voltage for controlling the speed of AC squirrel cage motors. The converter shall use a diode bridge rectifier to convert incoming AC power to a constant DC voltage bus. The inverter section shall be a voltage source design with a sine-weighted pulse-width modulated output. The output voltage is to vary

proportionally with the output frequency to maintain a constant volts/hertz value up to 60 hz.

B. Include in the controller, power conversion components, power control logic devices and regulator circuitry. Provide full digital control of frequency and voltage.

C. The variable frequency drives shall all be by one manufacturer.

D. Provide VFDs large enough to handle the nameplate full load current of the installed motor; do not select VFDs based solely on motor HP. Verify the nameplate full load current of the installed motor and provide the appropriately sized VFD for the installed motor.

E. The VFD and all associated equipment shall have a short circuit current rating (SCCR) of at least that specified in 16050.

F. The variable torque drives shall be rated for 100% continuous current, 110% current for one minute. Constant torque drives shall be rated for 100% continuous current, 150% current for one minute.

G. The drive shall also include as functional components: capacitors for DC bus, single control logic board, terminal blocks for connection of incoming power, motor terminations, operator controls and transient suppressor.

H. Include motor current overload protection.

I. Provide keypad and backlit display for display and control, to be mounted on the front panel of the VFD enclosure.

J. Enclosure: NEMA 12 with thermostatically controlled cabinet fan. Other components specified herein and shown on the drawings shall be installed in the enclosure.

K. Provide a 5% input line reactor (this is required in addition to the VFDs internal reactance).

L. Provide a fused surge protection device for VFD power in the VFD enclosure; the surge protection device rating shall be as recommended by the VFD manufacturer.

M. Provide two (2) filtered stainless steel louvers and one (1) ten-inch (6") thermostatically controlled exhaust fan to properly ventilate the controller enclosure. Exhaust fan shall operate based on temperature setting or when the variable frequency drive operates. Exhaust fan shall be mounted near the top of the enclosure. In addition, provide a Thermostat to control the exhaust fan mounted at the top of the enclosure interior.

N. BYPASS STARTER

1. Provide a two-contactor bypass starter, across-the-line starter with VFD-Bypass selector switch, indicating pilot lights, and output contacts. Provide additional controls & relays required for a fully function bypass system.

2.3 VARIABLE DRIVE FUNCTIONS

A. Frequency Accuracy ±0.5%.

B. Operating Frequency Range Output: 0-60 Hz.

C. Adjustable Two Step Acceleration and Deceleration Times: 0.1-1600 seconds.

D. Lower Limit Frequency Adjustment: 0-60 Hz.

E. Upper Limit Frequency Adjustment: 0-60 Hz.

2.4 VARIABLE DRIVE CONTROLS

A. Speed control, start/stop control, local/remote control on keypad.

B. Manual speed adjustment potentiometer, 10 turn, with dial counter, (remote mounted where indicated on Drawings).

C. Remote speed adjustment from 4-20 mA control signal, where indicated.

D. Remote start/stop.

E. Drive run and stop indicating lights.

F. Contact closure for external indication of drive running and fault (rating 120 VAC, 1 AMP).

G. Elapsed time meter.

H. Hand-Off-Auto Selector Switch

I. VFD-Bypass selector switch

J. Other interlocks, indicating lights and controls indicated on Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install drive equipment in control panels as shown on the Drawings.

B. Provide services of a factory trained technician for startup and training, a minimum of one day per type of drive installed.

END OF SECTION

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SECTION 16410

SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Circuit Breakers

2. Switch Assemblies

B. Related Sections

1. Section 16070 – Electrical Hangers and Supports

1.2 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers.

B. NEMA KS 1 – Enclosed Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

1.3 SUBMITTALS

A. Shop drawings, product data, and reports.

B. Circuit breaker trip current and let-through current curves, outline dimensions, and terminal lug sizes.

1.4 REGULATORY REQUIREMENTS

A. Use circuit breakers and switch assemblies listed by Underwriter's Laboratories, Inc., and suitable for specific application.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Eaton

B. Square D

C. Siemens

D. Or equal

2.2 MOLDED CASE CIRCUIT BREAKER

A. CIRCUIT BREAKER: NEMA AB-1. FS W-C-375.

B. Service Conditions:

1. Temperature: 40 C.

C. Interrupting Rating: For circuit breakers that are part of a panelboard or other equipment, the interrupting rating shall be equal to or greater than that of the equipment. For stand-alone circuit breakers, the interrupting rating shall be a minimum of 22,000 AIC.

D. Enclosure: NEMA 12 dust tight industrial indoor dry locations, NEMA 3R raintight (lockable) for outdoor locations, and NEMA 4X stainless steel for wet and damp locations.

E. Configuration: Inverse time automatic tripping. Instantaneous automatic tripping, for motor circuit protection.

F. Field-Adjustable Trip Circuit Breaker: NEMA AB 1; provide circuit breakers with frame sizes 125 amperes and larger with mechanism for adjusting long time, short time continuous current, short time, long time pickup current, and instantaneous setting for automatic operation.

G. Ratings: NEMA AB 1; as scheduled.

H. Provide a lockable hasp with each circuit breaker.

2.3 SWITCH ASSEMBLIES

A. Interrupting Rating: The interrupting rating shall be a minimum of 22,000 AIC.

B. Fusible Switch Assemblies: NEMA KS 1; FS W-S-865; heavy duty, quick-make, quick-break load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF and ON positions. Fuse Clips: FS W-F-870. Designed to accommodate Class R fuses unless otherwise indicated.

C. Enclosure: NEMA 12 for indoor dry locations, NEMA 3R raintight (lockable) for outdoor locations, and NEMA 4X stainless steel for wet and damp locations

2.4 MANUAL TRANSFER SWITCH

A. Manual transfer switches shall be molded case circuit breaker and cam-lock type; knife switch or fused switches are not acceptable.

B. Manual transfer switch shall consist of (2) two mechanically interlocked molded case circuit breakers; kirk-locks are not acceptable, cam-style male connectors, power distribution block and grounding terminals, all housed within a padlockable enclosure.

C. Manual transfer switch enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated steel. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure. Access for portable generator cables with female cam-style plugs shall be via a) drawn flange cable entry openings in the bottom of enclosure for wall mount units, or b) hinged lower door for pad mount units. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened. Enclosure shall be powder coated after fabrication; color shall be gray.

D. Quantity of male input cams must be as required to meet the specified amperage.

E. Cam-style male connectors (inlets) shall be UL Listed single-pole separable type and rated 200 amps at 600VAC. Cam-style male connectors shall be color coded. Cam-style male connectors shall be provided for each phase and ground and shall also be provided for neutral if required. Each of the phase cam-style male connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. The neutral cam-style male

connectors, if required, shall be factory wired to a power distribution block. None of the cam-style male connectors shall be accessible unless both molded case circuit breakers are in the "OFF" position and the main access door is open.

F. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.

G. Molded case circuit breakers shall be UL Listed, and the short circuit interrupt rating shall be a minimum of at least that specified in 16050. Trip rating of the molded case circuit breakers shall be at least that of the transfer switch rating or as shown on the drawings. One molded case circuit breaker shall be fed from utility power; the other molded case circuit breaker shall be fed from the cam-style male connectors to supply power from a portable generator. Both molded case circuit breakers shall include UL Listed door-mounted operating mechanisms (with provisions for a locking device), preventing the opening of the main access door unless both breakers are in the "OFF" position. Both molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The (2) molded case circuit breakers shall be safety interlocked by mechanical means to ensure that only one breaker can be closed at any given time.

H. Manual transfer switch shall include permanently affixed operation instructions.

I. Manufacturer:

1. ESL Power Systems, Inc., StormSwitch Series
2. Equal by Eaton
3. Equal by Siemens
4. Or equal

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

A. Install circuit breakers and switch assemblies where shown on Drawings, in accordance with manufacturer's instructions.

B. Provide all necessary hardware and supports and make all wiring connections.

C. Support equipment of this Section in accordance with Section 16070.

D. Provide fuses in all fusible switch assemblies, whether fuses are shown on the drawings or not. For HVAC equipment, coordinate fuse size required with HVAC contractor.

3.3 ADJUSTING

A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in the circuit. Use trip settings provided by the Engineer. Coordinate with Engineer to request settings at least 2 weeks prior to starting up the equipment.

3.4 FIELD QUALITY CONTROL

A. Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker and switch assembly.

B. Verify circuit continuity on each pole in closed position.

END OF SECTION

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SECTION 16415

AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Automatic transfer switch.

1.2 REFERENCES

A. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.

B. NFPA 70 - National Electrical Code.

C. UL 1008 - Standard for Automatic Transfer Switches.

1.3 QUALITY ASSURANCE

A. Manufacturer - Company specializing in automatic transfer equipment with 3 years documented experience.

1.4 SUBMITTALS

A. Shop drawing, product data and reports.

B. Product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.

C. Operation and Maintenance Data

1. Submit operation and maintenance data.

2. Include instructions for operating equipment.

3. Include instructions for operating equipment under emergency conditions when engine generator is running.

4. Identify operating limits which may result in hazardous or unsafe conditions.

5. Document ratings of equipment and each major component.

6. Include routine preventative maintenance and lubrication schedule.

7. List special tools, maintenance materials, and replacement parts.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable National Electrical Code for emergency standby electrical systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Russelectric

B. ASCO

C. Eaton

D. or equal

2.2 AUTOMATIC TRANSFER SWITCH

A. Description - NEMA ICS 2; automatic transfer switch. Equipment to be designed, manufactured, and tested in accordance with UL 1008 and NEMA ICS2, Part 2-447.

B. Configuration - Electrically-operated, mechanically-held “break-before-make” , open transition transfer switch.

C. The transfer switch shall be equipped with a safe external manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the transfer switch enclosure while the enclosure door is closed.

2.3 RATINGS - NEMA ICS 2; AS FOLLOWS:

A. Voltage - 480 volts, three phase, four wire, 60 Hertz.

B. Switched Poles - 3.

C. Load Inrush Rating - Combination Tungsten Lamp, electric discharge lamp, resistive load.

D. Continuous Rating - 125 amperes.

E. Withstand and close-on Current Rating:

1. 22,000 rms symmetrical amperes (3-cycle), when used with any molded case circuit breaker.

2.4 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator - Upon initiation by normal source monitor.

B. Time Delay to Start Alternate Source Engine Generator - 0 to 300 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source - Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source - 0 to 300 seconds, adjustable.

E. Initiate Retransfer Load to Normal Source - Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power - 0 to 300 seconds, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down - 0 to 10 minutes, adjustable, of unloaded operation.

H. Programmed Transition – Transfers load to neutral position for 0-10 seconds (adjustable), disconnected from sources, to allow inductive load voltages to decay.

I. Programmable Engine Exerciser - A 7/14 day electronic time switch with digital display for automatic weekly or bi-weekly testing of the engine-generator set. The exerciser shall be fully programmable and backed up by a permanent battery, and shall allow automatic testing with or without load. The system shall bypass exerciser control if normal source fails during exercising period.

J. Engine Cranking Timer - Open starter circuit if engine fails to start after 45 seconds.

2.5 ACCESSORIES

A. Indicating Lights - Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

B. Test Switch - Mount in cover of enclosure to simulate failure of normal source.

C. Transfer Switch Auxiliary Contacts - 1 normally open; 1 normally closed.

D. Normal Source Monitor - Monitor each line of normal source voltage; initiate engine starting when voltage drops below 70 percent after a 3 second time delay. Initiate retransfer when voltage is restored to greater than 90 percent of rated value.

E. Alternate Source Monitor - Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 80 percent.

F. In-Phase Monitor – Inhibit transfer until power source and load are within 10 electrical degrees.

G. Provide timer to prevent excessive transfer and retransfer operation during momentary line voltage dips.

H. Phase Rotation Sensing – Monitor phase rotation; inhibit transfer if phase rotation is not the same.

I. Loss of Single Phase Detection – Monitors voltage on all three phases; initiates engine starting when any phase is lost after 100 msec time delay.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

A. The automatic transfer switch shall be mounted on the wall as shown on the Drawings.

B. Set the programmed transition to provide enough time delay for all motor driven equipment to come to a complete stop.

C. Set the in-phase monitor for 10 electrical degrees. Adjust the following time delay settings as required.

1. Set the time delay to start alternate source engine generator at 10 seconds.
2. Set the time delay before transfer to alternate power source at 0 seconds.
3. Set the time delay before transfer to normal power at 60 seconds.
4. Set the time delay before engine shut down at 10 minutes.

3.3 FIELD QUALITY CONTROL

A. Test transfer switch operation by opening the main disconnect to simulate a power outage. Observe startup of the generator and transfer of load to the generator. Close the main disconnect. Observe transfer to utility power and engine cool down and shut down. Record time delays.

B. Where possible, correct malfunctioning transfer switch at site, and then retest to demonstrate compliance. Otherwise remove the transfer switch and ship it back to the manufacturer for repair or replacement.

3.4 PERSONNEL TRAINING

A. Operating Personnel Training - Train personnel in procedures for starting-up, testing and operating transfer switches and auxiliary equipment.

END OF SECTION

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SECTION 16440

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Panelboards

2. Molded case circuit breakers

B. Related Sections

1. Section 16075 – Electrical Identification

2. Section 16410 – Switches and Circuit Breakers

1.2 REFERENCES

A. NEMA PB 1 - Panelboards.

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

1.3 SUBMITTALS

A. Provide outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

PART 2 PRODUCTS

2.1 MANUFACTURERS - PANELBOARDS

A. Panelboards, 208/120 volt with mains from 100 amperes to 400 amperes, max 42-84 branch circuits and no branch breakers over 100 amperes, shall be:

1. Eaton, PRL-1

2. Square D, NQ

3. Siemens, P1

4. General Electric, AQ

5. or equal

B. Panelboards, 480/277 volt with mains from 100 amperes to 400 amperes, max 60 branch circuits with MCB, or max 74 branch circuits with MLO, and no branch breakers over 225 amperes, shall be:

1. Eaton, PRL-3

2. Square D, NF or I-Line

3. Siemens, P3

4. General Electric, AD

5. or equal

2.2 PANELBOARDS

A. Panelboards: NEMA PB-1; circuit breaker type

B. Enclosure: NEMA Type 12 or as indicated on Drawings

C. Provide cabinet front with hinged cover, and hinged door with flush lock. Finish in manufacturer's standard gray enamel.

D. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards. Provide separate insulated neutral bus, where required.

E. Provide factory installed lockable hasps for all breakers.

F. Ratings

1. All panels and individually mounted circuit breakers shall have short circuit ratings as follows:

a. 240 Volt Class Panels/Breakers - 10 kAIC

b. 480 Volt Class Panels/Breakers - 22 kAIC

c. All panelboards shall be UL listed and labeled. Panels shall have ratings not less than the short circuit ratings available from the power sources.

d. Panelboards shall be labeled with a UL short circuit rating. Panelboards shall be fully rated.

G. Trims

1. Trims for all panelboards shall be supplied with a door-in-hinged-door. Interior door shall cover all circuit breaker handles and not uncover any live parts. Outer hinged door shall have a piano/continuous hinge and shall open to provide access to all wire gutter space on both sides of circuit breakers. Doors shall have a semi-flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners. Refer to drawings for surface or recessed mounted. Switching device handles shall be accessible.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Provide circuit breakers in accordance with Section 16410.

B. Provide bolt-in circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

C. Provide factory installed lockable hasps for all breakers.

D. Field-Adjustable Trip Circuit Breaker: NEMA AB 1; provide circuit breakers with frame sizes 125 amperes and larger with mechanism for adjusting long time, short time continuous current, short time, long time pickup current, and instantaneous setting for automatic operation.

E. Trip-free mechanism independent of manual handle control.

F. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

G. Provide ground fault interrupter circuit breakers for circuits indicated on Drawings.

H. Do not use single pole breakers with handle tie for multipole use.

PART 3 EXECUTION

3.1 INSTALLATION

A. Panel board shall be wall mounted as shown on the Drawings.

B. Install wall mounted panelboards plumb in conformance with NEMA PB 1.1, at a height of 6 feet to the top of the panelboard.

C. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

D. Make all electrical connections including grounding.

E. Provide engraved nameplates in accordance with Section 16075.

3.2 FIELD QUALITY CONTROL

A. With all equipment connected and functioning normally, measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20%, rearrange circuits in the panelboard to balance the phase loads within 20%. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection - Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

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SECTION 16460

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

B. Dry type two winding transformers

1.2 REFERENCES

A. ANSI/NEMA ST 20 - Dry Type Transformers for General Applications

1.3 SUBMITTALS

A. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

B. Nameplate data per NEMA ST20-3.26

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site and store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

B. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 PRODUCTS

MANUFACTURERS

A. Eaton

B. Square D

C. Siemens

D. Or equal

2.2 DRY TYPE TWO WINDING TRANSFORMERS

A. Dry Type Transformers: ANSI/NEMA ST 20; factory-assembled, air-cooled dry type shielded transformers; ratings as shown on the Drawings

2.3 INSULATION SYSTEM

A. Transformers shall be insulated as follows:

1. 3 kVA through 15 kVA: Class C insulation for 185°C total temperature, based on 115°C rise.

B. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40°C maximum ambient, with a 30°C average ambient over 24 hours.

C. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

2.4 CORE AND COIL ASSEMBLIES

A. Transformer core shall be constructed with high grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10 percent above the highest tap voltage. The core laminations shall be tightly clamped and compressed.

B. Coils shall be wound of electrical grade aluminum with continuous wound construction. The complete coil and core shall be isolated from the enclosure by means of rubber, vibration absorbing mounts.

C. On units rated below 15 kVA, the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock resistant seal.

D. On units rated 15 kVA and above, the core and coil assembly shall be impregnated with a non-hydroscopic, thermo-setting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration-absorbing pads and securely bolted to the base to minimize sound transmission.

E. Windings shall be totally enclosed, and the transformers shall be capable of continuous operation at rated load, voltage and frequency in accord with ANSI C57.96. The coils shall be thoroughly insulated from the bushings and from each other. Bushings shall be built into coils. The complete coil and core assembly shall be impregnated with waterproofing material having high-insulating and good heat-conducting properties, in accord with NEMA ST-20.

2.5 ENCLOSURES

A. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 color weather-resistant enamel. All transformers shall be equipped with a wiring compartment suitable for conduit entry from top, bottom and/or sides, and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90°C. The core of the transformer shall be visibly grounded to the enclosure.

B. The enclosure construction shall be ventilated, NEMA 2, dripproof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide suitable weathershields over ventilation openings.

C. Ventilation openings shall be designed such that foreign objects inserted through these openings are deflected from energized parts.

2.6 RATINGS

A. Transformers 15KVA and above shall have voltage and kVA ratings indicated on the drawings, with four 2-1/2% taps – two above and two below rated voltage.

B. Transformers shall exceed the minimum efficiencies as required by TP-1, 1996.

2.7 WIRING/TERMINATIONS

A. Recommended external cable shall be rated 90 degrees C for all designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer. Provide primary and secondary lugs per the Tighe & Bond transformer schedules.

2.8 MISCELLANEOUS

A. All terminal compartments shall be located near the bottom of the transformers.

B. Mounting: Transformers shall be suitable for floor or wall mounting, as shown on the Drawings.

C. Isolate core and coil from enclosure using vibration-absorbing mounts.

D. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

E. Terminal Connections: Copper bus or lead wire

PART 3 EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

A. Set transformer plumb and level.

B. Mount transformers on vibration isolating pads for isolating the transformer noise from the building.

C. Name all wiring connections, including grounding.

D. Install separate grounding electrode for bonding of neutral and all ground connections.

E. Furnish and install supports for all transformers.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make tap adjustments.

C. Perform routine, design, prototype, and sound level tests for each unit rating.

END OF SECTION

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SECTION 16490

COMPONENTS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Control switches and pilot devices
2. Control relays, time delay relays
3. Control power transformers
4. Elapsed time meters
5. Intrinsically safe barrier
6. Alarm light
7. Alarm horn
8. Surge Protection Device (SPD)

1.2 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control Systems

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies

1.3 SUBMITTALS

A. Drawings to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, wire numbers, dimensions, support points, nameplate legends

B. Project Record Documents

1. Accurately record actual locations of control equipment. Revise diagrams included in Drawings to reflect actual control device connections.

C. Operation and Maintenance Data

1. Provide instructions for adjusting and resetting time delay relays, timers, and counters.
2. Provide recommended preventive maintenance procedures and materials.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience

1.5 SPARE PARTS

A. Furnish 2 complete control switches, pilot devices, and relays with contacts for each type utilized in this project.

B. Furnish 1 complete time delay relay and clock timer complete with contacts for each type utilized in this project.

PART 2 PRODUCTS

2.1 CONTROL SWITCHES AND PILOT DEVICES

A. Mounting Hole: 30.5mm

B. Contact: NEMA ICS 2; Form C

C. Contact Rating: NEMA ICS 2; A150, 10 amps

D. Type: Industrial heavy duty oil tight type, waterproof (NEMA 4) or explosion proof (NEMA 7) as required and/or indicated on the Drawings, pushbuttons, selector switches, and stop buttons

E. Indicating Lights: LED. Lens color as indicated on Drawings. Lights which are not illuminated during normal equipment operation, such as "Fault" and "Warning", shall be push-to-test.

F. Legend Plates with markings and weatherproof requirements as indicated on the Drawings. Legend plates for emergency stops shall be yellow background.

G. Manufacturers

1. Eaton/Cutler-Hammer, Model 10250T (w/Logic Level Blocks or class I, Div. 2 rated blocks as required)

2. Allen-Bradley, 800T/800H (w/PenTuff Blocks or class I, Div. 2 rated blocks as required)

3. Equal by Square D

4. or equal

2.2 CONTROL RELAYS, TIME DELAY RELAYS

A. Contacts: Form C, convertible contacts, each relay shall include at least one spare set of contacts

B. Contact Rating:

1. Relays for non-motor loads: Pilot Duty Rating NEMA C300, R300; 15 Amp @ 120VAC inductive, 7.5A @ 240VAC inductive, 7 Amp @ 277VAC general purpose, 7 Amp @ 30VDC resistive

2. Relays for motor loads: Rated insulation voltage 250V IEC, 300V UL; 1/3HP @ 120VAC, 3/4HP @ 240VAC.

C. Coil Voltage: 120 volts, 60 Hz., AC unless otherwise required for application.

D. Relay: Interposing/isolation relay, square base, rail mounted

E. Electrical life (cycles): 100,000 minimum

F. Time Delay Relays: Dial type timing relay with timing range from .05s to 300 hrs, DPDT 5 Amp contacts, din rail mounting, specific model as required for specific control application.

G. Manufacturers

1. Allen Bradley: Bulletin 700, 700-HC for non-motor loads, 700-HK for motor loads, Bulletin 700-HR dial type time delay relay
2. Equal by Eaton/Cutler Hammer
3. Square D 9001 K/SK
4. or equal

2.3 CONTROL POWER TRANSFORMERS

A. Transformer: NEMA ST 1; machine tool transformer with isolated secondary winding

B. Power Rating: 75 va, minimum

C. Voltage Rating: 480 volts primary; 120 volts secondary

2.4 ELAPSED TIME METERS

A. Type: Synchronous motor driven, elapsed time meter, 0 - 99999.9 hours range, non-reset type

B. Mounting: semi-flush panel mounting

C. Manufacturers

1. Kessler Ellis
2. Eagle
3. General Electric
4. or equal

2.5 INTRINSICALLY SAFE BARRIER FOR FLOAT SWITCHES

A. Description: Intrinsically safe barrier

B. Voltage: 120 volts

C. Number of Inputs: 4

D. Outputs: 4 isolated NO/NC contacts. Rated for 3A up to 250V AC, or 2A at 24V DC

E. Manufacturer

1. IDEC, EB3C Series
2. Equal by Allen Bradley
3. Or equal

2.6 CURRENT MONITORING RELAY

A. Description: Relay that detects the presence of AC current

B. Operation: When the monitored current exceeds the trip point for longer than 30 milliseconds, the internal relay energizes. When the monitored current drops below the trip point for longer than 0.5 seconds, the internal relay de-energizes.

C. Control Voltage: 120 VAC

D. Trip Point: 1 ampere, fixed

E. Relay: SPDT, 211 VA at 120 VAC

F. Enclosure: Lexan dust cover; 8-pin plug-in

G. Furnish base

H. Manufacturer:

1. Diversified electronics part no. CMB 120-AFA-1 with RB-08 PC base or equal

2. Equal by Allen Bradley

3. Or equal

2.7 ALARM LIGHT

A. Type: Heavy duty LED alarm light with non-metallic base and lens

B. Description: NEMA 4X glass-reinforced thermoplastic polyester resin base, shatter-resistant polycarbonate fresnel lens

C. Flash Rate: Field-selectable, 65 flashes per minute or steady on

D. Color as indicated in drawings or schedule.

E. Mounting: Wall (Conduit, if necessary)

F. Power: 120VAC or 24VDC, as required

G. Manufacturer

1. Edwards-Signaling 105XBRM

2. Equal by Federal Signal

3. Equal by Course-Hinds

4. or equal

2.8 ALARM HORN

A. Type: Diaphragm with projector, NEMA 4X

B. Construction: Zinc die-casting housing, stainless steel diaphragm, weatherproof back box

C. Voltage: 120 VAC or 24 VDC

D. Output: Adjustable, 78 to 101 dB (at 10 feet)

E. Manufacturer

1. Edwards Signaling, Model 870P-N5 (120 VAC model) or Model 871P-G1 (24 VDC model)

2. Equal by Federal Signal

3. Equal by Crouse-Hinds

4. Or equal

2.9 SURGE PROTECTION DEVICE (SPD) – ENCLOSED STAND ALONE

A. UL 1449, 4th Edition listed

B. Surge current/phase (8/20 µs): 1 Event: 200kA

C. Surge Life/Phase (8/20 µs): 10,000 Events: 10kA

D. Service Voltage: 277/480 volts, three-phase

E. Features:

1. LED status indicators for protection present and protection reduced.

2. Audible alarm with silence button

3. EMI/RFI filtering

4. Form C relay contact for fault/power loss signal

5. Surge counter with reset button

F. Modes of protection: Line-to-neutral, line-to-ground, line-to-line, neutral-to-ground.

G. Each phase shall be guarded by at least three redundant protection paths.

H. Lead length shall be as short and straight as possible, avoiding ninety-degree bends in the wire (LB fittings or similar will not be accepted). If the installed lead length must exceed five feet, the contractor shall use a low impedance cable that minimizes the lead length impact to the installed performance of the SPD.

I. Enclosure: NEMA 4, 14-gauge steel, powder coated.

J. 10-year warranty

K. Manufacturer:

1. MCG Surge Protection Model 200LS-277Y

2. Equal by Citel

3. Or Equal

L. Provide a 30-amp circuit breaker disconnect for the SPD.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install devices and equipment in accordance with manufacturer's instructions.

B. Install individual relays and time delay relays in enclosures.

C. Make electrical wiring interconnections as shown on Drawings.

END OF SECTION

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SECTION 16500

LUMINAIRES

PART 1 GENERAL

1.1 SUMMARY

A. Examine all drawings and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

B. Coordinate work with that of all other Trades affecting or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

C. Provide all material, labor and equipment, to complete the work of this Section in strict accordance with the design engineer's plans and specifications, and with all applicable codes, rules, and standards.

D. The work under this Section shall include furnishing and installing interior and exterior lighting fixtures.

E. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.

F. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified hereinunder.

1.2 SUBMITTALS

A. Prepare and submit complete shop drawings of lighting fixtures required on this project to the Engineer for approval.

B. Submit samples of each material under this Section requested by the Engineer for approval. Samples shall be in size and form requested by the engineer, and reasonable to show characteristics, color and finishes of the materials.

C. Submit complete manufacturer's product data of all materials and systems to the engineer for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, dimensions and all other pertinent technical data required for complete product and product use information.

D. All shop drawings shall have clearly marked the appropriate specification number of drawing designation for identification of the submittal.

E. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

F. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents. Fixtures or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other materials submitted for approval. Make modifications to fixtures in accordance with Engineers comments concerning submittals, as a part of the work of this Section.

1. For each and every light fixture type the manufacturer shall submit the following information in the order listed below.

a. Light fixture cut sheet

b. Fixture accessories

c. Ballast/Driver cut sheet

d. Lamp cut sheet

1.3 REFERENCED STANDARDS

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of, the Contract Documents:

1. NFPA 70: National Electrical Code
2. UL: Underwriters' Laboratories
3. NEC: National Electrical Code
4. CBM: Certified Ballast Manufacturers Association
5. IES: Illuminating Engineering Society
6. ASTM: American Society for Testing and Materials
7. ANSI: American National Standards Institute

1.4 SUBSTITUTIONS

A. No substitutions shall be permitted. The Contractor shall submit one (1) of the fixtures listed for each fixture type as indicated on the lighting fixture schedule.

1.5 COORDINATION

A. For exterior pole mounted fixtures, furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of materials shall be made to the project by the materials supplier in accordance with the instructions of the Contractor.

B. The Contractor shall provide adequate storage space for the materials, shall be responsible for all items of materials after receipt from the supplier, and shall replace all materials lost or damaged after delivery and receipt.

C. The Contractor shall furnish the materials supplier with receipts for all materials and accessory items received, and shall send copies of these receipts to the Engineer.

1.7 SPARE PARTS

A. For non-LED fixtures, provide 1 replacement lamp for each lamp installed.

B. For non-LED fixtures, provide 2 of each ballast type.

PART 2 MATERIALS

2.1 GENERAL

A. Provide materials, equipment, appurtenances, and workmanship for the work of this Section conforming to the highest commercial Standards as specified and indicated on the drawings. Make fixture parts and components not specifically identified or indicated on the drawings, of materials most appropriate to their use or function, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the fixtures.

2.2 MARKING OF FIXTURES

A. Mark fixtures according to proper lamp type. Provide markings that are clear and readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.

2.3 MATERIALS AND FABRICATION

A. Provide fixtures, completely factory assembled, wired, and equipped with necessary sockets, wiring, shielding, reflectors, channels, lenses and other parts and appurtenances necessary to complete the fixture installation and deliver to project site ready for installation.

2.4 FINISHES

A. The engineer shall select finishes and indicate the color selections on the shop drawing submittals.

2.5 FIXTURE WIRING

A. Provide wiring channels and wireways free from projections and rough or sharp edges throughout. At points or edges over which conductors shall pass and may be subject to injury or wear, round bush to make a smooth contact surface with the conductors.

B. Install insulated bushings at points of entrance and exit of flexible wiring.

2.6 LED LIGHT FIXTURES, DRIVERS AND MODULES

A. Provide drivers for LED lamps that are suitable for the electrical characteristics of the supply circuits to which they are to be connected, and which are suitable for operating the specified lamps.

B. Provide drivers conforming to UL, ETL and ANSI Specifications and displaying labels or symbols of approval by the UL or ETL and of certification as tested by the UL / ETL. Design, fabricate and assemble component parts of drivers in accordance with the latest requirements of the NEC. This Driver protection shall be provided by a built-in self-resetting thermally actuated device that shall remove the driver from line when excessive driver temperature is reached.

C. Rigidly mount drivers to the inside of the top of the fixture housing, with driver surfaces and housing in complete contact for efficient conduction of driver heat, unless specifically indicated to the contrary. Permanently affix driver mounting screws to the

fixture housing. Provide only fixtures whose design, fabrication and assembly prevent overheating or cycling of LED's and drivers under any condition of use.

D. Provide identical drivers within each fixture type unless otherwise noted.

E. Switched fixtures which incorporate battery inverter packs for emergency lighting circuits shall include a second "hot leg" conductor to allow for fixtures to be switched without activating the battery inverter pack. Battery inverter packs shall only be activated during loss of normal power.

F. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) – compliant.

G. LED drivers shall include the following features unless otherwise indicated:

1. Minimum efficiency: 85% at full load
2. Minimum Operating Ambient Temperature: -20 C (-4 F).
3. Input Voltage: 120/277V (±10%) at 60Hz.
4. Integral short circuit, open circuit, and overload protection
5. Power Factor: ≥ 0.95.
6. Total Harmonic Distortion: ≤ 20%
7. Comply with FCC 47 CFR Part 15
8. Provide 0-10V dimming controls.

H. LED modules shall include the following features unless otherwise indicated:

1. Comply with IES LM-79 and LM-80 requirements.
2. Minimum color rendering index (CRI) 82.
3. Color temperature shall be 4100K unless otherwise specified in Lighting Fixture Schedule. Color temperature shifts shall comply with ANSI C78 377A for LED binning with further sub-binning restrictions of chromatic to be at or below the visual threshold of perceivable color variation not exceeding the 3 step MacAdam Ellipse line that crosses the black body locus as indicated on the LM79 report. Such restrictions documentation compliance shall be submitted as part of the submittal process.
4. Minimum Rated Life: 50,000 hours per IES L70
5. Light output lumens in accordance to the specified manufacturer and catalog number as indicated in the Lighting Fixture Schedule.

2.7 EXTERIOR FIXTURES

A. Provide fixtures designed and manufactured specifically for outdoor service. Make components, including nuts, bolts, rivets, springs, and similar parts, of materials of effective corrosion resistance, or of materials which have been subjected to finishing treatment which shall ensure such resistance.

B. Provide fixtures for use outdoors or in areas designated as wet or damp locations, which are suitably and effectively gasketed to prevent access of moisture into electrical components or enclosing diffusers, lenses or globes.

C. Provide metal parts of fixtures for use in outdoor, wet or damp locations which are specified as requiring painting with suitable weather and moisture resisting qualities equal to epoxy-based coatings.

D. Provide anodized aluminum for aluminum parts of exterior fixtures which are not specified as requiring a painted finish.

2.8 FIXTURE DESCRIPTIONS

A. Provide fixtures that conform to the above Standards and criteria as indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

C. Examine excavation and concrete foundation for lighting poles.

3.2 INSTALLATION

A. Install in accordance with manufacturers instructions, NEC, and as indicated on Drawings.

B. Install suspended luminaires using pendants supported from swivel hangers, 15 degree free swing from vertical, ½ inch hub, 200 pound (minimum) fixture weight. Provide pendant length required to suspend luminaire at indicated height.

C. Install surface mounted luminaires and adjust to align with building lines and with each other. Secure to prohibit movement.

D. Install accessories furnished with each luminaire.

E. Unless otherwise shown, connect emergency lighting units and exit signs to same circuit that feeds the surrounding lighting. Use flexible conduit as indicated.

F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

G. Bond products and metal accessories to branch circuit equipment grounding conductor.

H. Install specified lamps in each emergency lighting unit after installation is completed and prior to project completion.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Replace fixtures that have failed at Substantial Completion.

B. Aim and adjust exterior luminaires to provide illumination levels and distribution as directed.

3.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean finishes and touch up damage.

D. Clean photometric control surfaces as recommended by manufacturer.

END OF SECTION

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