MAINE TURNPIKE AUTHORITY

MAINE TURNPIKE

CONTRACT DOCUMENTS

CONTRACT 2018.18

KENNEBUNK TRAVEL PLAZAS
FUEL SYSTEM REPLACEMENT
MILE 25.5 SB AND NB

NOTICE TO CONTRACTORS

PROPOSAL

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FINAL LIEN AND CLAIM WAIVER AND AFFIDAVIT

SPECIFICATIONS

MAINE TURNPIKE AUTHORITY

SPECIFICATIONS

The Specifications are divided into two parts:
Part I, Supplemental Specifications and Part II, Special Provisions.

The Maine Turnpike Supplemental Specifications are additions and alterations to the 2014 Maine Department of Transportation Standard Specifications. See Subsection 100.1.

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MAINE TURNPIKE AUTHORITY

NOTICE TO CONTRACTORS

Sealed Proposals will be received by the Maine Turnpike Authority for:

CONTRACT 2018.18

KENNEBUNK TRAVEL PLAZAS
FUEL SYSTEM REPLACEMENT
MILE 25.5 SB AND NB

at the office of the Maine Turnpike Authority, 2360 Congress Street, Portland, ME, until 11:00 a.m., prevailing time as determined by the Authority on July 24, 2018 at which time and place the Proposals will be publicly opened and read. This Project includes a wage determination developed by the State of Maine Department of Labor.

Bids will be accepted from Contractors who can demonstrate a minimum of three (3) successful similar fuel system demolitions and constructions. A list of these constructions, including Owner contact information, shall accompany the Proposal. A summary of each construction must also be submitted demonstrating experience with, but not limited to: demolition of underground storage tanks and piping, proper management of contaminated soils and groundwater, installation of underground tanks, piping, electrical and communication, concrete dispenser slab constructions, canopy installation, dispenser installation, electrical, communication, lighting, and fire suppression system installations. The contractor must also submit a list of Certified Tank Installers that will be assigned to this project.

The work consists of removing and replacing the underground gas and diesel storage tanks, with owner furnished underground storage tanks, at the Kennebunk southbound and northbound travel plazas, providing final installation of temporary gas and diesel dispensers using owner supplied aboveground storage tanks, associated electrical, mechanical, drainage, site work, maintenance of traffic and all other work incidental thereto in accordance with the Plans and Specifications.

Plans and Contract Documents may be examined by prospective Bidders weekdays between 8:00 a.m. and 4:30 p.m. at the office of the Maine Turnpike Authority, 2360 Congress Street, Portland, Maine. **The half size Plans** and Contract Documents may be obtained from the Authority upon payment of Fifty ($50.00) Dollars for each set, which payment will not be returned. Checks shall be made payable to: Maine Turnpike Authority. The Plans and Contract Documents may also be downloaded from a link on our website at http://www.maineturnpike.com/project-and-planning/Construction-Contracts.aspx.

For general information regarding Bidding and Contracting procedures, contact Nate Carll, Purchasing Manager, at (207) 482-8115. For information regarding Schedule of Items, plan holders list and bid results, visit our website at **http://www.maineturnpike.com/project-and-planning/Construction-Contracts.aspx** . For Project specific information, fax all questions to Nate

Carll, Purchasing Manager, at (207) 871-7739 or email ncarll@maineturnpike.com. Responses will not be prepared for questions received by telephone. Bidders shall not contact any other Authority staff or Consultants for clarification of Contract provisions, and the Authority will not be responsible for any interpretations so obtained.

All work shall be governed by the Specifications entitled "State of Maine, Department of Transportation, Standard Specifications, Revision of November 2014", "Standard Details, Revision of November 2014" and "Best Management Practices for Erosion and Sediment Control", latest issue. Copies and recent updates to these publications can be downloaded at: http://www.maine.gov/mdot/contractors/publications/ .

Proposals must be accompanied by an original bid bond, certified or cashier's check payable to the Maine Turnpike Authority in an amount not less than Five (5%) Percent of the Total Amount in the Proposal, but not less than $500.00. The Bidder to whom a Contract is awarded will be required to furnish a Surety Corporation Bond, satisfactory to the Authority, on the standard Contract Bond form of the Authority, for a sum not less than the Total Amount of the Proposal.

Proposals must be made upon the Proposal Forms furnished by the Authority separately with the Contract Documents, and must be enclosed in the sealed special addressed envelope provided therefore bearing the name and address of the Bidder, the name of the Contract, and the date and time of Proposal opening on the outside.

A pre-bid conference will be held on July 17, 2018 at 10:00 a.m. at the Maine Turnpike Authority, 2360 Congress Street, Portland, Maine.

The Authority reserves the unqualified right to reject any or all Proposals and to accept that Proposal which in its sole judgment will under all circumstances serve its best interest.

MAINE TURNPIKE AUTHORITY

Nate Carll
Purchasing Manager
Maine Turnpike Authority
Portland, Maine

Maine Turnpike Authority

MAINE TURNPIKE

PROPOSAL

CONTRACT 2018.18

KENNEBUNK TRAVEL PLAZAS
FUEL SYSTEM REPLACEMENT
MILE 25.5 SB AND NB

MAINE TURNPIKE AUTHORITY

PROPOSAL

CONTRACT 2018.18

KENNEBUNK TRAVEL PLAZAS
FUEL SYSTEM REPLACEMENT
MILE 25.5 SB AND NB

TO MAINE TURNPIKE AUTHORITY:

The work consists of removing and replacing the underground gas and diesel storage tanks, with owner furnished underground storage tanks, at the Kennebunk southbound and northbound travel plazas, providing final installation of temporary gas and diesel dispensers using owner supplied aboveground storage tanks, associated electrical, mechanical, drainage, site work, maintenance of traffic and all other work incidental thereto in accordance with the Plans and Specifications.

This Work will be done under a Contract known as Contract 2018.18 according to the Plans and Specifications which are on file in the office of the Maine Turnpike Authority, 2360 Congress Street, Portland, Maine.

On the acceptance of this Proposal for said Work, the undersigned will give the required bond with good security conditioned for the faithful performance of said Work, according to said Plans and Specifications, and the doing of all other work required by said Specifications for the consideration herein named and with the further condition that the Maine Turnpike Authority shall be saved harmless from any and all damages that might accrue to any person, persons or property by reason of the carrying out of said Work, or any part thereof, or by reason of negligence of the undersigned, or any person or persons under his employment and engaged in said Work.

The undersigned hereby declares that he/she has carefully examined the Plans, Specifications and other Contract Documents, and that he/she will contract to carry out and complete the said Work as specified and delineated at the price per unit of measure for each scheduled item of Work stated in the Schedule of Prices as follows:

It is understood that the TOTAL AMOUNT stated by the undersigned in the following Schedule of Prices is based on approximate quantities and will be used solely for the comparison of bids, and that the quantities stated in the Schedule of Prices for the various items are estimates only and may be increased or decreased all as provided in the Specifications.

SCHEDULE OF BID PRICES
CONTRACT NO. 2018.18
Kennebunk Travel Plazas
Fuel System Replacement
Mile 25.5 SB and NB

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
202.15	Remove Existing Manhole or Catch Basin	Each	1				
202.17	Removing Existing Structural Concrete	Lump Sum	1				
202.202	Removing Pavement Surface	Square Yard	1,290				
203.20	Common Excavation	Cubic Yard	4,790				
203.2312	Health and Safety Plan	Lump Sum	1				
203.2333	Disposal/Treatment of Special Excavation	Ton	6,000				
203.2334	Disposal/Treatment of Contaminated Groundwater	Lump Sum	1				
206.061	Structrural Earth Excavation - Drainage Minor Structures Below Grade	Cubic Yard	50				
304.10	Aggregate Subbase Course - Gravel	Cubic Yard	4,450				
304.14	Aggregate Base Course - Type A	Cubic Yard	1,985				
403.207	Hot Mix Asphalt, 19.0 mm Nominal Maximum Size	Ton	1,920				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
403.208	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size	Ton	1,200				
403.2084	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (sidewalks, drives, islands & incidentals)	Ton	57				
403.213	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (Base and Intermediate Base course)	Ton	1,180				
409.15	Bituminous Tack Coat, Applied	Gallon	1,140				
419.30	Sawing Bituminous Pavement	Linear Foot	2,360				
502.701	Concrete Gas Island and Slab	Cubic Yard	220				
502.702	Concrete Diesel Island and Slab	Cubic Yard	160				
502.703	Concrete Gas Tank Slab	Cubic Yard	45				
502.704	Concrete Diesel Tank Slab	Cubic Yard	18				
502.705	Concrete Fuel Tank Slab	Cubic Yard	60				
503.14	Epoxy-Coated Reinforcing Steel, Fabricated and Delivered	Pound	42,000				
503.15	Epoxy-Coated Reinforcing Steel, Placing	Pound	42,000				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
524.30	Temporary Structural Support	Each	4				
526.306	Temporary Concrete Barrier, Type I - Supplied by Authority (950 LF)	Lump Sum	1				
527.34	Work Zone Crash Cushion - TL-2	Each	4				
603.155	12 Inch Reinforced Concrete Pipe - Class III	Linear Foot	470				
603.165	15 inch Reinforced Concrete Pipe - Class III	Linear Foot	390				
604.071	Catch Basin Type A1	Each	5				
604.09	Catch Basin Type B1	Each	1				
604.15	Manhole	Each	1				
604.18	Adjusting Manhole or Catch Basin To Grade	Each	5				
604.182	Cleaning Existing Catch Basin and Manhole	Each	1				
604.246	Catch Basin Type F5	Each	2				
604.30	Oil-water Separator System	Each	2				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
606.356	Underdrain Delineator Post	Each	1				
607.18	6 Foot Chain Link Safety Fence	Linear Foot	400				
608.08	Reinforced Concrete Sidewalk	Square Yard	9				
609.11	Vertical Curb Type 1	Linear Foot	530				
609.12	Vertical Curb Type 1 - Circular	Linear Foot	43				
609.234	Terminal Curb Type 1 - 4 Foot	Each	2				
609.38	Reset Curb Type 1	Linear Foot	1,140				
610.08	Plain Riprap	Cubic Yard	3				
613.319	Erosion Control Blanket	Square Yard	12				
615.07	Loam	Cubic Yard	240				
618.13	Seeding Method Number 1	Unit	20				
619.1201	Mulch - Plan Quantity	Unit	20				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
619.1202	Temporary Mulch	Lump Sum	1				
622.10	Transplanting Shrub	Each	4				
626.13	18" x 12" x 18" Quazite Junction Box	Each	6				
626.22	Non-metallic Conduit	Linear Foot	950				
626.32	24 inch Diameter Foundation	Each	3				
626.36	Remove or Modify Concrete Foundation	Each	3				
627.18	12 inch Solid White Pavement Marking Line	Linear Foot	16				
627.731	Temporary 6 Inch Black Pavement Marking Tape	Linear Foot	2,060				
627.733	4" White or Yellow Painted Pavement Marking Line	Linear Foot	500				
627.744	6" White or Yellow Painted Pavement Marking Line	Linear Foot	500				
629.05	Hand Labor, Straight Time	Man Hour	40				
631.12	All Purpose Excavator (including operator)	Hour	40				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
631.172	Truck Large (including operator)	Hour	80				
631.221	Small Front End Loader (Including Operator)	Hour	40				
631.36	Foreman	Hour	40				
634.208	Remove and Reset Light Standards	Each	3				
634.22	Temporary Lighting (SB Plaza)	Lump Sum	1				
634.23	Temporary Lighting (NB Plaza)	Lump Sum	1				
639.19	Field Office, Type B	Each	1				
639.191	Remove and Reset Field Office	Lump Sum	1				
645.109	Remove and Reset Sign	Each	12				
652.312	Type III Barricades	Each	2				
652.33	Drum	Each	110				
652.34	Cone	Each	110				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
BROUGHT FORWARD:							
652.35	Construction Signs	Square Foot	278				
652.361	Maintenance of Traffic Control Devices	Lump Sum	1				
652.38	Flaggers	Hour	200				
652.41	Portable Changeable Message Sign	Each	2				
655.101	#6 AWG Wire	Linear Foot	2,030				
655.11	#10 AWG Wire	Linear Foot	1,020				
656.50	Baled Hay, in place	Each	10				
656.632	30 Inch Temporary Silt Fence	Linear Foot	820				
659.10	Mobilization	Lump Sum	1				
800.01	Removal of Underground Tanks - Gas and Diesel (SB Plaza)	Lump Sum	1				
800.02	Removal of Underground Tanks - Gas and Diesel (NB Plaza)	Lump Sum	1				
800.03	Underground Tank Installation - Gas and Diesel (SB Plaza)	Lump Sum	1				

CARRIED FORWARD:

Item No	Item Description	Units	Approx. Quantities	Unit Prices in Numbers		Bid Amount in Numbers	
				Dollars	Cents	Dollars	Cents
			BROUGHT FORWARD:				
800.04	Underground Tank Installation Gas and Diesel (NB Plaza)	Lump Sum	1				
800.05	Aboveground Diesel Tank Installation (SB Plaza)	Lump Sum	1				
800.06	Aboveground Diesel Tank Installation (NB Plaza)	Lump Sum	1				
800.07	Aboveground Gas Tank Installation (SB Plaza)	Lump Sum	1				
800.08	Aboveground Gas Tank Installation (NB Plaza)	Lump Sum	1				
800.20	Canopy Demolition - Gas and Diesel (SB Plaza)	Lump Sum	1				
800.21	Canopy Demolition - Gas and Diesel (NB Plaza)	Lump Sum	1				
800.50	New Canopy Installation - Gas and Diesel (SB Plaza)	Lump Sum	1				
800.51	New Canopy Installation - Gas and Diesel (NB Plaza)	Lump Sum	1				
			TOTAL:				

Acknowledgment is hereby made of the following Addenda received since issuance of the Plans and Specifications: _____

_____

_____

Accompanying this Proposal is an original bid bond, cashiers or certified check on _____ Bank, for _____, payable to the Maine Turnpike Authority. In case this Proposal shall be accepted by the Maine Turnpike Authority and the undersigned should fail to execute a Contract with, and furnish the security required by the Maine Turnpike Authority as set forth in the Specifications, within the time fixed therein, an amount of money equal to Five (5%) Percent of the Total Amount of the Proposal for the Contract awarded to the undersigned, but not less than $500.00, obtained out of the original bid bond, cashier's or certified check, shall become the property of the Maine Turnpike Authority; otherwise the check will be returned to the undersigned.

The performance of said Work under this Contract will be completed during the time specified in Subsection 107.1.

It is agreed that time is of the essence of this Contract and that I (we) will, in the event of my (our) failure to complete the Work within the time limit named above, pay to Maine Turnpike Authority liquidated damages in the amount or amounts stated in the Specifications.

The undersigned is an Individual/Partnership/Corporation under the laws of the State of _____, having principal office at _____, thereunto duly authorized.

_____ *(SEAL)*

_____ *(SEAL)*

Affix Corporate Seal
or Power of Attorney
Where Applicable

_____ *(SEAL)*

By: _____

Its: _____

Information below to be typed or printed where applicable:

INDIVIDUAL:

_____	_____
(Name)	(Address)

PARTNERSHIP - Name and Address of General Partners:

_____	_____
(Name)	(Address)
_____	_____
(Name)	(Address)
_____	_____
(Name)	(Address)
_____	_____
(Name)	(Address)

INCORPORATED COMPANY:

_____	_____
(President)	(Address)
_____	_____
(Vice-President)	(Address)
_____	_____
(Secretary)	(Address)
_____	_____
(Treasurer)	(Address)

STATEMENT OF QUALIFICATION

The undersigned, under the pains and penalty of perjury, offers the following information as evidence of his qualifications to perform the Work as bid upon according to all the requirements of the Plans and Specifications.

1. How long have you been in business under present business name? _____ Years

2. Have you ever failed to complete any work awarded? _____ Yes _____ No

   If Yes, provide explanation: _____

   _____

   _____

3. Bank Reference: _____

   _____

   _____

4. History of Contracts: On the following "History of Contracts" sheet, provide full information about all of your Contracts similar to this Contract. Bidder may copy the sheet to provide information for multiple projects. Blank sheets may be used for additional space. Please number additional pages as follow, P-9-2, P-9-3, P-9-4, etc.

5. Status of Contracts on Hand: On the following "Status of Contracts on Hand" sheet, provide full information about all of your Contracts.

_____
(Date)

_____
(Name of Bidder as appearing in submitted Proposal)

HISTORY OF CONTRACTS

PROJECT NAME:

OWNER:

LOCATION:

DESCRIPTION:

CONTRACT AMOUNT:

NAME OF SUBCONTRACTOR(S):

SUBCONTRACTOR'S CONTRACT AMOUNT(S):

CONTRACT COMPLETION DATE:

ACTUAL COMPLETION DATE:

LIST OF CERTIFIED TANK INSTALLERS FOR THIS PROJECT:

SUMMARY OF THE PROJECT SCOPE:

STATUS OF CONTRACTS ON HAND

OWNER	CONTACT NAME & TELEPHONE NO.	LOCATION OF WORK	DESCRIPTION OF WORK	GENERAL CONTRACTOR OR SUBCONTRACTOR	CONTRACT AMOUNT	BALANCE TO BE COMPLETED	ESTIMATED DATE OF COMPLETION

MAINE TURNPIKE AUTHORITY

MAINE TURNPIKE

YORK TO AUGUSTA

CONTRACT AGREEMENT

This Agreement made and entered into between the Maine Turnpike Authority, and sometimes termed the "Authority", and _____

_____

herein termed the "Contractor":

WITNESSETH: That the Authority and the Contractor, in consideration of the premises and of the mutual covenants, considerations and agreements herein contained, agree as follows:

FIRST: The parties hereto mutually agree that the documents attached hereto and herein incorporated and made a part hereof collectively evidencing and constituting the entire Contract to the same extent as if herein written in full, are the Notice to Contractors, the Accepted Proposal, the Specifications, the Plans, this Agreement, the Contract Bond and all Addenda to the Contract Documents duly issued and herewith enumerated:

_____

_____

SECOND: The Contractor for and in consideration of certain payments to be made as hereafter specified, hereby covenants and agrees to perform and execute all of the provisions of this Contract and of all documents and parts attached hereto and made a part thereof, and at his own cost and expense to furnish and perform everything necessary and required to construct and complete, ready for its intended purpose, in accordance with the Contract and such instructions as the Engineer may give, acceptable to the Authority, in the times provided, all of the Work covered and included under Contract No. _____ covering _____ as herein described.

THIRD: In consideration of the performance by the Contractor of his covenants and agreements as herein set forth, the Authority hereby covenants and agrees to pay the Contractor according to the Schedule of Prices set forth in the Proposal with additions and deductions as elsewhere herein provided in the times and in the manner stated in the Specifications. This Agreement shall insure to the benefit of, and shall be binding upon the parties hereto, and upon their respective successors and assigns; but neither party hereto shall assign or transfer his interest herein in whole or in part without the consent of the other, except as herein provided.

IN WITNESS WHEREOF the parties to this Agreement have executed the same in quintuplicate.

AUTHORITY -

MAINE TURNPIKE AUTHORITY

By: _____

Title: CHAIRMAN

Date of Signature: _____

ATTEST:

_____
Secretary

CONTRACTOR -

_____
CONTRACTOR

By: _____

Title: _____

Date of Signature: _____

WITNESS:

_____

CONTRACT BOND

KNOW ALL MEN BY THESE PRESENTS that _____

of _____ in the County of _____ and State of _____

as Principal, and _____ a Corporation duly organized under the

laws of the State of _____ and having a usual place of business in _____

_____

As Surety, are held and firmly bound unto the Maine Turnpike Authority in the sum of _____Dollars ($_____.___), to be paid to said Maine Turnpike Authority, or its successors, for which payment, well and truly to be made, we bind ourselves, our heirs, executors, successors and assigns jointly and severally by these presents.

The condition of this obligation is such that the Principal, designated as Contractor in the foregoing Contract No. _____ shall faithfully perform the Contract on his part and satisfy all claims and demands incurred for the same and shall pay all bills for labor, material, equipment and all other items contracted for, or used by him, in connection with the Work contemplated by said Contract, and shall fully reimburse the Obligee for all outlay and expense which the Obligee may incur in making good any default of said Principal, then this Obligation shall be null and void; otherwise it shall remain in full force and effect.

Signed and sealed this _____ day of _____, A.D., 201___

Witnesses: CONTRACTOR

_____ _____ *(SEAL)*

_____ _____ *(SEAL)*

_____ _____ *(SEAL)*

SURETY

_____ _____ *(SEAL)*

_____ _____ *(SEAL)*

_____ _____ *(SEAL)*

(Surety must attach copy of Power of Attorney showing authority of Office or Agent to execute bonds)

FINAL LIEN AND CLAIM WAIVER AND AFFIDAVIT

Upon receipt of the sum of _____, which sum represents the total amount paid, including the current payment for work done and materials supplied for Project No. _____, in _____, Maine, under the undersigned's Contract with the Maine Turnpike Authority.

The undersigned, on oath, states that the Final Payment of _____ is the final payment for all work, labor, materials, services and miscellaneous (all of which are hereinafter referred to as "Work Items") supplied to the said Project through _____and that no additional sum is claimed by the undersigned respecting said Project.

The undersigned, on oath, states that all persons and firms who supplied Work Items to the undersigned in connection with said Project have been fully paid by the undersigned for such Work Items or that such payment will be fully effected immediately upon receipt of this payment.

In consideration of the payment herewith made, the undersigned does fully and finally release and hold harmless the Maine Turnpike Authority, and its Surety, if any, from any and all claims, liens or right to claim or lien, arising out of this Project under any applicable bond, law or statute.

It is understood that this Affidavit is submitted to assure the Owner and others that all liens and claims relating to the Work Items furnished by the undersigned are paid.

_____
(Contractor)

By: _____

Title: _____

State of MAINE

County of _____

I, _____, hereby certify on behalf of _____
(Company Officer) *(Company Name)*

its _____, being first duly sworn and stated that the foregoing representations are
(Title)

are true and correct upon his own knowledge and that the foregoing is his free act and deed in said capacity and the free act and deed of the above-named

_____

.

(Company Name)

The above-named, _____, personally appeared before me this ____ day of _____ and swears that this is his free act and deed.

(SEAL)

_____
Notary Public

My Commission Expires: _____

MAINE TURNPIKE AUTHORITY

SPECIFICATIONS

PART I – SUPPLEMENTAL SPECIFICATIONS

(Rev. November 10, 2016)
Supplemental Specifications available on the Maine Turnpike website

MAINE TURNPIKE AUTHORITY

SPECIFICATIONS

PART II – SPECIAL PROVISIONS

MAINE TURNPIKE AUTHORITY

SPECIFICATIONS

PART II - SPECIAL PROVISIONS

All work shall be governed by the Maine Department of Transportation Standard Specifications, Revision of November 2014, except for that work which applies to sections of the Maine Department of Transportation Standard Specifications which are amended by the Maine Turnpike Supplemental Specifications and the following modifications, additions and deletions.

General Description of Work

The work consists of removing and replacing the underground gas and diesel storage tanks, with owner furnished underground storage tanks, at the Kennebunk southbound and northbound travel plazas, providing final installation of temporary gas and diesel dispensers using owner supplied aboveground storage tanks, associated electrical, mechanical, drainage, site work, maintenance of traffic and all other work incidental thereto in accordance with the Plans and Specifications.

Plans

The drawings included in these Contract Documents, and referred to as the Plans, show the general character of the work to be done under this Contract. They bear the general title "Maine Turnpike – Contract 2018.18 – Kennebunk Travel Plazas – Fuel System Replacement – Mile 25.5 SB & NB". The right is reserved by the Resident to make such minor corrections or alterations in the Plans as he deems necessary without change in the unit prices on the Schedule of Prices of the Proposal.

101.2 Definition

Holidays

The following is added after Memorial Day in the Supplemental Specifications:

Christmas 2018	12:01 p.m. (noon) preceding Monday to 6:00 a.m. the following Wednesday.
New Years 2019	12:01 p.m. (noon) preceding Monday to 6:00 a.m. the following Wednesday.
Independence Day 2019 (Fourth of July)	12:01 p.m. preceding Wednesday to 6:00 a.m. the following Monday

103.4 Notice of Award

The following sentence is added:

The Maine Turnpike Authority Board is scheduled to consider the Contract Award on July 26, 2018.

104.3.8 Wage Rates and Labor Laws

Section 104.3.8 Wage Rates and Labor Laws has been amended as follows:

The fair minimum hourly rates determined by the State of Maine Department of Labor for this Contract are as follows:

THIS DOCUMENT MUST BE CLEARLY POSTED AT THE PERTAINING STATE FUNDED PREVAILING WAGE CONSTRUCTION SITE

State of Maine
Department of Labor
Bureau of Labor Standards
Augusta, Maine 04333-0045
Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRSA §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid to laborers and workers employed on the below titled project.

Title of Project --------2018.18-Kennebunk Service Plaza Fuel System Replacement. Mile 25.5

Location of Project –Kennebunk, York County

2018 Fair Minimum Wage Rates
Heavy & Bridge York County

Occupation Title	Minimum Wage	Minimum Benefit	Total	Occupation Title	Minimum Wage	Minimum Benefit	Total
Backhoe Loader Operator	$20.00	$2.16	$22.16	Laborer (Includes Helper-Tender)	$16.50	$1.63	$18.13
Boom Truck (Truck Crane) Operator	$21.66	$6.86	$28.52	Laborer - Skilled	$21.00	$4.15	$25.15
Bricklayer	$24.00	$3.99	$27.99	Line Erector-Power/Cable Splicer	$25.75	$7.36	$33.11
Bulldozer Operator	$20.00	$4.06	$24.06	Loader Operator - Front-End	$21.00	$3.21	$24.21
Carpenter	$24.31	$10.58	$34.89	Mechanic- Maintenance	$20.00	$5.72	$25.72
Carpenter - Rough	$20.94	$4.46	$25.40	Mechanic- Refrigeration	$24.88	$4.76	$29.64
Cement Mason/Finisher	$17.00	$0.56	$17.56	Millwright	$29.90	$23.69	$53.59
Communication Equipment Installer	$20.00	$1.85	$21.85	Painter	$22.00	$3.06	$25.06
Comm Transmission Erector	$19.00	$3.57	$22.57	Paver Operator	$20.00	$3.78	$23.78
Microwave & Cell Crane Operator =>15 Tons)	$29.00	$10.84	$39.84	Pile Driver Operator	$25.00	$11.13	$36.13
Crusher Plant Operator	$17.75	$2.48	$20.23	Pipe/Steam/Sprinkler Fitter	$22.25	$8.62	$30.87
Diver	$32.00	$0.00	$32.00	Pipelayer	$28.00	$12.54	$40.54
Driller -Rock	$18.38	$2.60	$20.98	Pump Installer	$21.00	$3.73	$24.73
Earth Auger Operator	$23.76	$6.31	$30.07	Reclaimer Operator	$18.50	$2.85	$21.35
Electrician - Licensed	$30.07	$17.09	$47.16	Rigger	$20.00	$6.12	$26.12
Electrician Helper/Cable Puller (Licensed)	$27.00	$12.01	$39.01	Roller Operator - Earth	$15.88	$1.76	$17.64
Excavator Operator	$23.25	$3.71	$26.96	Roller Operator - Pavement	$18.30	$1.64	$19.94
Fence Setter	$16.00	$1.17	$17.17	Truck Driver - Light	$18.15	$2.88	$21.03
Flagger	$12.00	$0.00	$12.00	Truck Driver - Medium	$17.75	$1.82	$19.57
Grader/Scraper Operator	$21.33	$5.13	$26.46	Truck Driver - Heavy	$19.00	$3.19	$22.19
HVAC (Heat-Vent-Air Conditioning)	$23.00	$3.05	$26.05	Truck Driver - Tractor Trailer	$20.50	$5.46	$25.96
Ironworker – Ornimental	$22.48	$4.85	$27.70				
Ironworker - Reinforcing	$26.20	$12.15	$38.35				
Ironworker - Structural	$23.00	$6.26	$29.26				

The Laborer classifications include a wide range of work duties. Therefore, if any specific occupation to be employed on this project is not listed in this determination, call the Bureau of Labor Standards at the above number for further clarification.

Welders are classified in the trade to which the welding is incidental.

Apprentices - The minimum wage rate for registered apprentices are those set forth in the standards and policies of the Maine State Apprenticeship and Training Council for approved apprenticeship programs.

Posting of Schedule - Posting of this schedule is required in accordance with 26 MRSA §1301 et. seq., by any contractor holding a State contract for construction valued at $50,000 or more and any subcontractors to such a contractor.

Appeal - Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates.

Determination No: **HB-041-2018**

A true copy

Filing Date: **June 18, 2018**

Attest: Scott R. Cotnoir

Scott A. Cotnoir

Expiration Date: **12-31-2018**

Wage & Hour Director

BLS(Heavy & Bridge York)

THIS DOCUMENT MUST BE CLEARLY POSTED AT THE PERTAINING STATE FUNDED PREVAILING WAGE CONSTRUCTION SITE

State of Maine
Department of Labor
Bureau of Labor Standards
Augusta, Maine 04333-0045
Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRSA §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid to laborers and workers employed on the below titled project.

Title of Project -------- 2018.18-Kennebunk Service Plaza Fuel System Replacement. Mile 25.5

Location of Project – Kennebunk, York County

2018 Fair Minimum Wage Rates
Highway & Earth York County-Revised-

Occupation Title	Minimum Wage	Minimum Benefit	Total	Occupation Title	Minimum Wage	Minimum Benefit	Total
Asphalt Raker	$16.00	$0.44	$16.44	Ironworker – Ornamental	$23.13	$4.80	$27.93
Backhoe Loader Operator	$20.00	$2.23	$22.23	Ironworker - Reinforcing	$24.79	$10.60	$35.39
Boom Truck (Truck Crane) Operator	$21.66	$6.86	$28.52	Ironworker - Structural	$21.80	$4.88	$26.68
Bulldozer Operator	$22.00	$4.17	$26.17	Laborer (Includes Helper-Tender)	$14.50	$0.94	$15.44
Carpenter	$21.00	$2.36	$23.36	Laborer - Skilled	$17.00	$2.24	$19.24
Cement Mason/Finisher	$17.00	$0.56	$17.56	Line Erector-Power/Cable Splicer	$26.00	$7.59	$33.59
Crane Operator =>15 Tons)	$26.00	$5.97	$31.97	Loader Operator - Front-End	$19.25	$3.37	$22.62
Crusher Plant Operator	$17.50	$2.01	$19.51	Mechanic- Maintenance	$21.00	$3.15	$24.15
Diver	$28.50	$1.48	$29.98	Painter	$17.00	$0.00	$17.00
Driller -Rock	$18.38	$2.60	$20.98	Paver Operator	$18.38	$1.73	$20.11
Earth Auger Operator	$22.97	$6.17	$29.14	Pipelayer	$18.00	$3.16	$21.16
Electrician - Licensed	$26.00	$4.67	$30.67	Pump Installer	$21.00	$3.73	$24.73
Electrician Helper/Cable Puller (Licensed)	$17.00	$2.84	$19.84	Reclaimer Operator	$19.13	$2.98	$22.11
Elevator Constructor/Installer	$19.25	$1.62	$20.87	Roller Operator - Earth	$16.00	$1.89	$17.89
Excavator Operator	$21.13	$3.36	$24.49	Roller Operator - Pavement	$18.03	$2.19	$20.22
Fence Setter	$17.25	$1.72	$18.97	Screed/Wheelman	$18.60	$3.68	$22.28
Flagger	$12.00	$0.00	$12.00	Truck Driver - Light	$17.83	$3.74	$21.57
Grader/Scraper Operator	$21.33	$5.65	$26.98	Truck Driver - Medium	$18.00	$1.89	$19.89
Highway Worker/Guardrail Installer	$16.50	$0.79	$17.29	Truck Driver - Heavy	$16.38	$1.61	$17.99
Hot Top Plant Operator	$23.00	$3.90	$26.90	Truck Driver - Tractor Trailer	$19.00	$3.18	$22.18

The Laborer classifications include a wide range of work duties. Therefore, if any specific occupation to be employed on this project is not listed in this determination, call the Bureau of Labor Standards at the above number for further clarification.

Welders are classified in the trade to which the welding is incidental.

Apprentices - The minimum wage rate for registered apprentices are those set forth in the standards and policies of the Maine State Apprenticeship and Training Council for approved apprenticeship programs.

Posting of Schedule - Posting of this schedule is required in accordance with 26 MRSA §1301 et. seq., by any contractor holding a State contract for construction valued at $50,000 or more and any subcontractors to such a contractor.

Appeal - Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates.

Determination No: **HI-127-2018**

A true copy

Filing Date: **June 18, 2018**

Attest: Scott R Cotnoir

Scott A. Cotnoir
Wage & Hour Director

Expiration Date: **12-31-2018**

BLS(Highway & Earth York)

104.4.6 Utility Coordination

This Subsection is amended by the addition of the following:

These Special Provisions outline the arrangements which have been established by the Authority for coordination of the work to be accomplished by the utilities. The scope and schedule of utility relocation work is noted herein. The Contractor shall plan and conduct his work accordingly.

General

Utility working days are Monday through Friday, conditions permitting. Times are estimated on the basis of a single crew for each utility. Any times and dates mentioned are estimates only and are dependent upon favorable weather, working conditions, and freedom from emergencies. The Contractor shall have no claim against the Authority if they are exceeded.

The Contractor shall plan and conduct his operations in accordance with the following utility schedule. The Contractor must comply with all OSHA regulations pertaining to work adjacent to utility wires. The Contractor shall plan and conduct his work accordingly.

The following utilities are located within the Project limits. The Contractor shall ascertain the location of the existing utilities and any other necessary information by direct inquiry at the office of the following utility owners:

AERIAL AND UNDERGROUND UTILITIES

COMMUNICATION:

Maine Turnpike Authority
2360 Congress Street, Portland, Maine
Greg Hinds (207) 831-6808

Charter Communications
118 Johnson Road
Portland, ME
Peter DeTeso 207-318-6542
Andy Trottier 207252-2325

ELECTRIC:

Maine Turnpike Authority
2360 Congress Street, Portland, Maine
Greg Hinds (207) 831-6808
(Contractor shall note TESLA has recently installed underground electric; plans are available through MTA).

Kennebunk Light and Power
4 Factory Pasture Lane
Kennebunk, ME 04043
Todd Shea 207-985-3311

WATER
Maine Turnpike Authority
2360 Congress Street, Portland, Maine
Ralph Norwood 207-415-0917

Kennebunk, Kennebunkport, and Wells Water District
P.O. Box 88, Kennebunk, Maine
Jamie Paschal 207-985-3385

SEWER
Maine Turnpike Authority
2360 Congress Street, Portland, Maine
Ralph Norwood 207-415-0917

Kennebunk Sewer District
71 Water Street, Kennebunk, Maine
Michael Bolduc, Christopher Gallant 207-985-4741

GAS
Unitil Corporation
376 Riverside Industrial Parkway
Portland, ME 04103
Kelly Brown 207-541-2572

MAINE TURNPIKE AUTHORITY (MTA)

MTA requires 10 working days' notice prior to any excavation. In addition to the normal Contractor responsibility of complying with all Dig Safe rules, the Contractor shall request MTA to mark all MTA owned facilities within the project area.

CHARTER COMMUNICATIONS

Charter requires 10 working days' notice prior to any excavation.

KENNEBUNK LIGHT AND POWER (KLP)

KLP requires 10 working days' notice prior to any excavation.

KENNEBUNK SEWER DISTRICT (KSD)

KSD requires 10 working days' notice prior to any excavation.

KENNEBUNK, KENNEBUNKPORT, AND WELLS WATER DISTRICT (KKW)

KKW requires 10 working days' notice prior to any excavation.

UNITIL

Unitil requires 10 working days' notice prior to any excavation.

104.4.7 Cooperation with Other Contractors

This Subsection is amended by the addition of the following:

Adjacent contracts currently scheduled for the 2018 and 2019 construction seasons include:

MTA Contract 2019.XX - Kennebunk Northbound and Southbound Travel Plazas Parking Expansions.

The Contractor shall allow access to the site by the Authority's fuel vendor C.N. Brown for the removal and/or installation of their materials and equipment, as well as for fuel and goods deliveries to the fuel tanks and office in the plaza building.

The Contractor shall allow access to the site by the Authority's food service vendor HMS Host for deliveries to the service plaza.

The following Subsection is added:

105.2 Asbestos

This Subsection is amended by the addition of the following:

Portions of the existing electrical conduit may contain asbestos-cement material. Unless otherwise noted or directed, the Contractor shall assume all electrical conduit is asbestos-cement material. Removal of or making connections to this material shall be performed in a manner, and using techniques, that protects workers and environmental safety and health and complies with all local, State and Federal requirements for working with this type of material. As required, the Contractor shall utilize trained and certified personnel when making these connections. Removed asbestos-cement pipe shall be transported and disposed of in a legal manner.

The following Subsection is added:

105.8.2 Permit Requirements

The Project is subject to the requirements of the Maine Pollutant Discharge Elimination System (MPDES) General Permit for Stormwater Discharge from Construction Activity, as

promulgated by the US Environmental Protection Agency (US EPA) and Administrated by the Maine Department of Environmental Protection (DEP).

A Notice of Intent (NOI), accompanied by a preliminary Limit of Disturbance (LOD) plan was submitted by the Authority to the DEP for coverage under the Maine Construction General Permit (MCGP). Compliance with the erosion and sedimentation control requirements outlined in this Contract is required by the Contractor.

The Contractor shall prepare a LOD plan illustrating the Contractor's proposed limit of earthwork disturbance. The LOD plan shall show all construction access locations, field office locations, material and temporary waste storage locations, as well as include the Contract limits of earthwork disturbance. All applicable erosion and sedimentation control devices needed shall be detailed on the Contractor's LOD plan and are not limited to those devices shown on the Contract LOD plan. **This Plan shall be submitted for review and approval, to the Resident within 14 days of Contract award.** Payment for creating, revising, and completing this plan shall be incidental to Item 659.10, Mobilization.

The LOD for this Contract, which was submitted as part of the NOI, has been estimated to be 1.83 acres southbound and 2.43 acres northbound, plus an additional 1.0 acre for contractor access, totaling 5.26 acres.

At any time during the Contract, if the Limit of Disturbance needs to be adjusted to accommodate construction activities, the Contractor shall resubmit the LOD plan (including any additional erosion and sedimentation control measures needed) to the Resident for review and approval prior to any additional disturbance taking place:

- If the cumulative area of disturbance exceeds the estimated LOD noted above, by less than one acre, the Resident shall have a minimum of five (5) working days to approve the revised LOD plan.
- If the cumulative area of disturbance exceeds the estimated LOD noted above, by over one acre, the Resident shall first approve of the plan and then possibly resubmit the NOI for MaineDEP approval. The approval may take a minimum of 21 working days.

Compliance with the erosion and sedimentation control requirements outlined in this Contract is required by the Contractor.

The Contractor shall comply with the conditions outlined in the Maine Pollutant Discharge Elimination System General Permit for stormwater discharge associated with construction activity. The Contractor shall indemnify and hold harmless the Maine Turnpike Authority or its agents, representatives and employees against any and all claims, liabilities or fines arising from or based on the violation of the above noted permits.

107.1 Contract Time and Contract Completion Date

This Subsection is amended by the addition of the following:

All work shall be completed on or before June 21, 2019. The construction of the Southbound Plaza shall be substantially complete by December 21, 2018. The construction of the Northbound Plaza shall be substantially complete by June 21, 2019.

107.1.1 Substantial Completion

This Subsection is amended by the addition of the following:

Substantially complete shall be defined by the Authority as the following:

- Existing underground storage tanks decommissioned and disposed.
- Proposed underground storage tanks installed and made fully functioning.
- Final fuel systems operational and open to the public.
- Above ground storage tanks decommissioned, removed, and set as noted in the Plans and Specifications.
- Drainage systems installed and functioning.
- Traffic circulation returned to final (existing) conditions.
- All site work complete, base and intermediate pavement complete on Southbound (all pavement complete on Northbound), and disturbed slopes loamed, seeded and mulched, and erosion control measures installed where necessary.

Supplemental Liquidated damages on a calendar day basis in accordance with Subsection 107.8 shall be assessed for each calendar day that substantial completion is not achieved.

107.4.6 Prosecution of Work

Contractor shall provide Resident and the Authority's fuel operator, CN Brown, with 10 days' notice of Aboveground Fuel System delivery date, then coordinate with CN Brown for the Point-of-sale connections and all final testing. Contractor shall provide CN Brown five working days for Point-of-sale connections and all final testing and making the full temporary system operational.

The Authority's fuel operator, CN Brown, shall operate the aboveground storage tanks.

The Contractor shall not close access to or disrupt the existing fueling operations, Southbound, for any reason including but not limited to constructing: the temporary fuel system, oil-water separator, drainage and/or paving, until after 6:00am Tuesday following the Labor Day Holiday. Following the Labor Day Holiday, the contractor may close the left most fueling aisle to begin Phase 1 site construction but shall not terminate existing fueling system until the temporary system is fully operational. Truck and car parking, near the diesel and gas dispensers may be terminated, with the appropriate construction signing, for purposes of installing the temporary fuel system no earlier than August 27, 2018.

The Authority's fuel operator is responsible for removing the existing gas and diesel dispensers. The Contractor shall provide a minimum of five days' notice to the Resident of when the dispensers need to be removed. The fuel operator shall have five working days to remove dispensers.

The Contractor is allowed a maximum of 90 days for the operation of the aboveground storage tanks. Once aboveground tanks are operational, work shall proceed uninterrupted until substantial completion.

The Contractor shall submit to the Authority a construction schedule which shall document that the Contractor has the necessary labor and equipment to work immediately and continuously at the project site once the work area is closed to traffic. The intent of this specification is to minimize the amount of time for plaza disruption, while providing the Contractor sufficient time to complete the work in a diligent manner and to reopen the plaza parking, circulation, and fuel systems as prescribed by the project's Substantial Completion dates.

If surface paving of the southbound plaza is not completed by the southbound plaza substantial completion date, the following must occur:

- Drainage structures shall be lowered to intermediate pavement lift elevations and raised to final grade after surface paving.
- Parking stalls shall be restored with temporary pavement markings (paint) for the duration of winter shut down, then markings shall be installed again after final surface pavement is placed.
- This work is incidental to the contract.

No work that impedes traffic, is permitted on the northbound plaza until the southbound plaza has reached substantial completion.

The contractor shall plan for and provide access to the travel plaza and temporary fuel systems for delivery vehicles (food, supplies, gas, diesel, maintenance, etc.).

The following is a list of major milestone activities required for the Southbound Plaza:

- Construct temporary access ramp to diesel tanks from two-way perimeter road
- Remove raised islands and take receipt of and install owner purchased above ground gas and diesel storage tanks. Installation also includes providing power and communications to the tanks.
- Install temporary kiosk (supplied by the Authority's fuel operator) including providing power and communication protective barrier and temporary lighting
- Decommission and remove underground gas and diesel tanks
- Take receipt of and install owner purchased gas and diesel tanks
- Remove and dispose existing kiosk and canopies
- Take receipt of and install vendor supplied gas and diesel dispensers
- Design and install gas and diesel canopies
- Decommission aboveground storage tanks and transport to Kennebunk Maintenance until they are ready to be installed at the Northbound Plaza.

The major milestone activities required for the Northbound Plaza are the same as the Southbound Plaza except for the decommissioned aboveground storage tanks shall be removed and transported to Kennebunk Maintenance upon completion of the work.

107.6 Completion Incentives and Disincentives

This Subsection is amended by the addition of the following:

The Authority will pay the Contractor an incentive per calendar day for each day the work, required to satisfy the Substantial Completion Date, is achieved prior to the date specified in Subsection 107.4.6. The incentive date, incentive per calendar day, and the maximum incentive associated with each Interim Completion date is listed in the following table.

	Date	Incentive per calendar day	Max Incentive
Southbound Service Plaza – Interim Completion Date 1	November 21, 2018	$2,100	$63,000
Northbound Service Plaza – Interim Completion Date 2	May 21, 2019	$4,200	$126,000

The "day" begins at 12:01 a.m. and ends at 12:00-midnight.

Payment for incentive will be included in the pay requisitions after the Interim completion date.

The incentive date is a "no excuse date". The Authority will not allow any excuses by the Contractor, including but not limited to contract adjustments, material supply schedule, coordination with CN Brown, and weather.

107.8 Supplemental Liquidated Damages

This Subsection is amended by the addition of the following:

Supplemental Liquidated Damages shall be assessed in the following amounts:

$2,100 per calendar day for each day not achieving Southbound Plaza Substantial Completion date, and
$4,200 per calendar day for not achieving Northbound Plaza Substantial Completion date.

These same Supplemental Liquidated Damage Amounts shall also be assessed for each calendar day not achieving Final Completion.

Supplemental Liquidated Damages shall run concurrent if necessary, that is, $2,100/day for Southbound Plaza plus $4,200/day for Northbound Plaza at the same time if neither are achieved per Substantial Completion date or Final Completion date.

SPECIAL PROVISION

SECTION 203

EXCAVATION AND EMBANKMENT

203.01 Description

The following paragraph is added:

This work shall consist of cutting, removing and disposing of the full depth of existing bituminous concrete pavement at the approaches to the bridge structures within the limits of work as shown on the Plans or as approved by the Resident. The pavement shall be sawcut to the full depth of pavement at the limits of the excavation to provide a clean, vertical cut surface.

203.04 General

The following sentence is added to the end of the third paragraph.

There are no approved waste storage areas or waste areas within the Project limits unless shown on the Plans. Unsuitable materials shall be disposed of off-site in accordance with Subsection 203.06.

All excavations shall be accomplished in accordance with the applicable OSHA Standards. The Resident reserves the right to request the Contractor to prepare an excavation plan. This plan shall include, but not necessarily be limited to, the limit and depth of excavation, side slope, shoring, trench box and utility support.

203.10 Embankment Construction - General

The thirteenth and fourteenth paragraphs are deleted and replaced with the following:

All portions of the embankment shall be compacted in accordance with the designated embankment compaction requirements specified for the Project.

The existing slopes should be benched as shown on the drawings prior to placing additional fill. Embankment fill should be placed in lifts which extend laterally beyond the limits of the design side slopes such that the specified degree of compaction is achieved within the limits of the completed embankment. The slopes should then be trimmed back to design dimensions.

203.16 Winter Construction of Embankments

The word “core” is deleted from the first and second sentences in the first paragraph.

203.18 Method of Measurement

The following paragraphs are added:

There will be no additional payment for the required excavation plan, and costs shall be incidental to the Excavation items.

SPECIAL PROVISION

SECTION 203

EXCAVATION AND EMBANKMENT

(Contaminated Soil and Groundwater Management)

203.01 General

The work under this Specification shall be performed in conformance with the procedures and requirements described herein for the following activities: contaminated soil handling, reuse, temporary stockpiling, transportation, storage and disposal and contaminated water handling, storage, treatment, and disposal. This Specification also addresses contaminated soil location, identification and classification. The intent of this Specification is to ensure that contaminated soil and/or water encountered during construction will be managed in a manner that protects worker health and safety, public welfare and the environment.

A representative from the Authority's Environmental Services Department shall be notified at least five (5) working days prior to beginning any excavation of the contaminated soil. The representative shall be on site to observe and document the work. For unanticipated contaminated areas see Subsection 203.10.

203.02 Environmental Site Conditions

The Maine Turnpike's Environmental Office has conducted a series of assessments related to the Kennebunk Service Plaza. A pre-construction Limited Phase II Investigation for the Project area was completed to obtain a general understanding of the presence of petroleum impacted soil and groundwater for both southbound and northbound plaza sites.

The results of these investigations indicate that the subsurface area beneath a portion of both sites have been impacted by petroleum. Data associated with this determination is available for review at the Maine Turnpike Headquarters. A summary conclusion of findings is as follows:

- PID headspace screening and oleophilic dye test results indicate the presence of petroleum in soil at both service plazas, but laboratory sample results did not reveal the presence of any petroleum related EPH or VPH ranges and target compounds above applicable regulatory guidelines. While these data are confirmation that releases have occurred, soil remediation work does not appear to be necessary. However, the current sample data set was collected at the periphery of UST facility components so it is our opinion that the potential exists to encounter contaminated soils above guidelines requiring remediation closer to the tank systems. Any excess soil generated during future UST replacement work will require further characterization and disposal of as a special waste.
- Groundwater results indicate that sampled groundwater at several locations at both plazas exceeds the Petroleum Remediation Guidelines and/or the Construction Worker RAGs. Based on this finding, groundwater will have to be properly managed during tank replacement work, and any construction workers that have the potential to encounter

contaminated groundwater should be properly trained in accordance with pertinent provisions Occupational Safety & Health Administration (OSHA) 1910.120.

203.03 General Procedure for Excavating Contaminated Soils and Groundwater

- The MTA and RE will engage an environmental professional including a Maine C.G. to oversee facility removal work, provide field screening services with a PID and oleophilic dye tests in accordance with DEP SOP TS004, and prepare appropriate UST closure reports for MTA to submit to DEP in accordance with Chapter 691.
- The contractor shall assume any groundwater encountered during excavation is contaminated and properly containerize and dispose of the groundwater offsite at a licensed disposal facility. The Kennebunk Sewer District has indicated their possible acceptance of groundwater pending the amount of contamination, the amount of groundwater generated per day, and the requirement that water be run through a Frac tank to remove sediment. Final acceptance by the Kennebunk Sewer District is not guaranteed and shall be coordinated by the Contractor.
- Based on field screening results, the contractor shall segregate soils for reuse onsite or offsite disposal. In accordance with TS004, the following criteria shall be used to characterize soils (based on using a MniRAE PID):
    - Soils for unrestricted reuse (i.e. "clean" soil)
        - Any soil with no visual indications of contamination
        - Any soil with an oleophilic dye test yielding a "negative" result, and
        - Any soil with a PID reading less than 40 parts per million (ppm), i.e. the leaching to groundwater field screening guideline
    - Lightly contaminated soil
        - Any soil with slight discoloration related to contamination
        - Any soil with an oleophilic dye test yielding a "positive or slightly positive" result
        - Any soil with a PID reading exceeding 40 ppm but less than 1,500 ppm
    - Highly contaminated or petroleum saturated soil
        - Any soil with visible gross contamination
        - Any soil with an oleophilic dye test yielding a "saturated" result
        - Any soil with a PID reading exceeding 1,500 ppm

Note that these field screening guidelines may be adjusted by the Resident and their environmental planner usingTS004 based on the PID instrument in use:

Table 1: Approved PID Field Cleanup and Notification Guidelines

Cleanup Scenario	Soil size [grams]	Ion	Thermo	Passport	Foxboro	MiniRAE	Photon
Leaching to GW/ Notification	200	80	60	60	50	40	40
Resident/ Park User	20	700	275	500	250	350	300
Outdoor Commercial Worker/ Excavation-Construction Worker	5	1200	500	850	375	1500	400

Note: No adjustment is made for set points; the response factor should be 1.0 for all instruments.

Based on these characterizations, the following soil management practices shall be employed:

- Soil characterized for unrestricted use can be relocated and reused as general construction material anywhere on the service plaza. If excess soil is generated that cannot be reused this soil should be appropriately evaluated and/or sampled for laboratory analysis prior to reuse.
- Soil characterized as lightly contaminated should be properly stockpiled, covered, and managed as a contaminated material, but can be reused in the vicinity of the fueling systems and this project's borrow needs. Any excess lightly contaminated soil that is not to be reused should be properly characterized and disposed or recycled offsite.
- Soil characterized as highly contaminated or petroleum saturated should either be live loaded or temporarily stockpiled until sufficient volume has been accumulated and shipped offsite for proper disposal or recycling. The contractor my request Resident approval for on-site reuse of this material. A final determination will be made in concert with the MTA and MaineDEP Project Manager as to the level of contamination.
- Stockpiled contaminated soils shall be placed on an impervious surface atop polyethylene sheeting, be properly covered with poly sheeting at the end of each work day or during inclement weather, and appropriate erosion/sedimentation controls should be used in the vicinity of the stockpiles to prevent stormwater from leaching or washing contaminants to nearby impervious surfaces or stormwater management systems.

The Authority's designated representative is responsible for signing any manifests or bills of lading required to transport and dispose of contaminated soil. All documentation and paperwork associated with the transport and disposal of Group 2 and Group 3 soils (i.e., manifests/bills of lading, weigh slips, invoices, permits, etc.) shall be forwarded to the Maine Turnpike Authority's Environmental Services Coordinator at 2360 Congress Street, Portland, Maine 04102 within 30 days of the last shipment of soil to the licensed facility.

203.04 Secured Stockpile Area

Should the Contractor utilize a Temporary Secured Stockpile Area (hereafter referred to as a "Secured Stockpile"), they shall install a continuous one-foot (0.30 m) high compacted soil berm around the Secured Stockpile (see Secured Stockpile Area – Materials below for Specifications pertaining to soil berm, liner, cover and barricades). The Secured Stockpile shall be placed on a liner of 20-mil polyethylene and securely covered with 20-mil polyethylene. The polyethylene liner and cover shall be placed over the soil berm and be installed to ensure that precipitation water drains directly to the outside of the berm perimeter while leachate from the contaminated soil is retained within the stockpile by covering with a polyethylene. The Secured Stockpile and soil berm shall be enclosed within a perimeter of temporary concrete barriers or security fence. The area within the temporary concrete barriers (or security fence) shall be identified as a "restricted area" to prevent unauthorized access to the contaminated soils. The Contractor shall submit to the Resident a plan (sketch and sections) of the proposed secured stockpile area.

203.05 Secured Stockpile Area - Materials

A. Polyethylene. Polyethylene used for liner and cover in the Secured Stockpile Area shall have a minimum of 20-mil thickness and shall meet the requirements of ASTM D3020.

B. Common Borrow. Fill used in the construction of the Temporary Secured Stockpile Area soil berm shall consist of Common Borrow and meet the requirements of Subsection 703.18.

C. Concrete Barriers or Security Fence. Concrete Barriers or Security Fence to form the sides of the Temporary Secured Stockpile Area shall meet the requirements of Section 526 or Subsection 607.

203.06 Health and Safety/Right-to-Know

Contractors and subcontractors are required to notify their workers of the history of the area and contamination that may be present and to be alert for evidence of contaminated soil and groundwater. The Contractor shall notify the Resident at least 72-hours prior to commencing any excavation.

The Contractor shall prepare a site specific Health and Safety Plan (HASP) for its workers and subcontractors who may work in the contaminated area of the site. A Qualified Health and Safety Professional shall complete the HASP. The HASP shall be submitted to the Authority in accordance with the Submittal section below. The Qualified Health and Safety Professional will be an expert in field implementation of the following federal regulations:

29 CFR 1910.120 or 29 CFR 1926.65	Hazardous Waste Operations, and Emergency Response
29 CFR 1910.134	Respiratory Protection
29 CFR 1926.650	Subpart D - Excavations
29 CFR 1926.651	General Requirements
29 CFR 1926.652	Requirements for Protective Systems

The Contractor shall designate a person to provide direct on-site supervision of the work in the contaminated area. This person shall have the training and medical surveillance under OSHA 1910.120 (e) and (f) respectively, as detailed above and in addition be qualified as a construction Competent Person [OSHA 1926.32 (f) and (l)]. It is the responsibility of this designated person to make those inspections necessary to identify situations that could result in hazardous conditions (e.g., possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions), and then to insure that corrective measures are taken.

Work inside contaminated trench sections may be subject to OSHA's permit-required confined space regulations under 29 CFR 1910.146.

Submittals. The Contractor shall submit for Authority and the Authority's Environmental Services Coordinator, review a site specific Health and Safety Plan (HASP) to the Resident at least two weeks in advance of any excavation work on the Project.

Health and Safety Monitoring. Within the contaminated area of the Project, the Contractor's designated person shall monitor the worker breathing zone for those constituents specified in the Contractor's HASP. The Contractor shall provide all required health and safety monitoring equipment.

203.07 Dewatering

It is likely that groundwater will be encountered during excavation and should its removal become necessary to complete work, it will be treated as "contaminated" water. The Contractor shall inform the Resident before any dewatering commences. The "contaminated" water shall be pumped into a temporary holding tank(s). The Contractor will be responsible for the procurement of any holding tank(s). Any testing, treatment and/or disposal of the stored, petroleum contaminated water shall be undertaken by the Contractor in accordance with applicable Federal, State and local regulatory requirements.

203.08 On-Site Water Storage Tanks - Materials

If dewatering within the identified contaminated area becomes necessary the holding tanks used for temporary storage of contaminated water pumped from excavations shall be contamination-free and have a minimum capacity of 2,000 gallons

203.09 Dust Control

The Contractor shall employ dust control measures to minimize the creation of airborne dust during construction within the contaminated area. As a minimum, standard dust control techniques shall be employed where heavy equipment and the public will be traveling. These may include techniques such as watering-down the site or spreading hygroscopic salts.

203.10 Unanticipated Contamination.

If the Contractor encounters previously undiscovered contamination or potentially hazardous conditions related to contamination, the Contractor shall suspend work and secure the area. The Contractor will then notify the Resident immediately. The Resident will then notify the Authority. These potentially hazardous conditions include, but are not limited to, buried fuel piping, vapor recovery piping, "oil saturated soils", strong odors or the presence of petroleum sufficient to cause a sheen on the groundwater. The area of potential hazard shall be secured to minimize health risks to workers and the public and to prevent a release of contaminants into the environment. The source of the suspected contamination will be evaluated by the Resident (or MTA Environmental representative). As appropriate, the Resident will notify the Maine Department of Environmental Protection's Response Services Unit in Augusta, and the Authority's Environmental Services Coordinator. The Kennebunk Fire Department must also be notified prior to removal of buried storage tanks and associated piping. The Contractor will evaluate the impact of the hazard on construction, amend the HASP if necessary, and with the Resident's approval, restart work in accordance with the procedures of this Special Provision.

203.11 Method of Measurement.

Health and Safety Plan (HASP) will be measured for payment by the lump sum.

Disposal/Treatment of Special Excavation will be measured for payment by the ton.

Disposal/Treatment of Contaminated Groundwater will be measured for payment by the lump sum.

203.012 Basis of Payment.

Health and Safety Plan (HASP) will be paid for at the Contract lump sum price which payment shall be full compensation for development of a Health and Safety Plan (HASP) and providing health and safety equipment and personnel.

Disposal/Treatment of Special Excavation (contaminated soils) will be paid for at the Contract unit price per ton which payment shall be full compensation for excavating, loading, hauling, treatment, placing, grading and compacting, and all necessary equipment and labor. Only soil excavated from within the area shown on the plans or as designated by the Resident will be paid under this pay item.

Disposal/Treatment of Groundwater will be paid for at the Contract unit price per Lump sum which payment shall be full compensation for pumping excavations, loading, hauling, treatment, and all necessary equipment and labor. Only groundwater pumped from excavations with this project will be paid under this pay item.

There will be no measurement for identification and environmental screening of contaminated soil material or groundwater (this will be done by the Resident or Authority's Environmental Services Coordinator).

Construction of a Temporary Secured Stockpile Area, or groundwater holding tank, if necessary, will not be measured separately for payment, but shall be incidental to Items 203.2312, 203.2333, and 203.2334.

Hauling Surplus contaminated soils to the Temporary Secure Stockpile area or placement and removal of contaminated soils in or out of the Temporary Secure Stockpile area will not be measured separately for payment, but shall be incidental to Items 203.2312 and 203.2333.

All hauling and any subsequent management/placement of contaminated soils and/or groundwater shall be incidental to Items 203.2312, 203.2333, and 203.2334.

There will be no separate measurement for additional laboratory testing of contaminated soil that is required by the landfill or treatment facility. Testing shall be incidental to Item 203.2333, and 203.2334.

Payment will be made under:

Pay Item		Pay Unit
203.2312	Health and Safety Plan	Lump Sum
203.2333	Disposal/Treatment of Special Excavation	Ton
203.2334	Disposal/Treatment of Contaminated Groundwater	Lump Sum

SPECIAL PROVISION

SECTION 206

STRUCTURAL EXCAVATION

206.02 Construction Methods

The following paragraphs are added:

There are no approved waste storage areas or waste areas within the Project limits. Unsuitable materials shall be disposed of off-site in accordance with Subsection 203.06.

SPECIAL PROVISION

SECTION 401

HOT MIX ASPHALT PAVEMENT

Section 401 of the Maine Turnpike Authority 2016 Supplemental Specifications is modified as follows:

401.01 Description

The following paragraph is added:

A Quality Control Plan(QCP) is required.

401.02 Materials

Section 401.02 is deleted in its entirety and replaced with the following:

Aggregates for HMA Pavements Coarse Aggregate and fine aggregate for HMA pavements shall be graded such that when combined in the proper proportions, including filler if required, the resultant blend will meet the composition of mixture for the type of pavement specified. Materials shall meet the requirements specified in Section 700 – Materials:

Asphalt Cement	702.01
Aggregates for HMA Pavement	703.07
RAP for HMA Pavement	703.08
HMA Mixture Composition	703.09

Mainline Surface HMA Coarse aggregate: The material retained on the No. 4 sieve, shall consist of angular fragments obtained from crushed quarry stone and be free of dirt or other objectionable materials. Coarse aggregate shall have a Micro-Deval value of 16.0 percent or less as determined by AASHTO T 327. The crushed stone shall have a maximum of 1.5% material finer than the No. 200 mesh when tested in accordance with AASHTO T-11. Flat and elongated particles shall not exceed a maximum of 8% at a 5:1 ratio in accordance with ASTM D-4791. Coarse aggregate angularity shall be a minimum of 95/90 in accordance with AASHTO T-335.

Mainline Surface HMA Fine aggregate: The material passing the No. 4 sieve, shall be crushed manufactured sand free from dirt, clay balls, or other objectionable material. Natural sand may be incorporated into the mix at a rate no greater than 13 percent by weight of total aggregate. The unconfined void content of the fine aggregate blend shall be a 45 minimum value when tested in accordance with AASHTO T-304, method A. AASHTO T-176 sand equivalent value shall be 45 minimum.

Asphalt Low Modulus Joint Sealer: Asphalt Low Modulus Joint Sealer shall be a modified asphalt and rubber compound designed for sealing and improving the strength and performance of the base asphalt cement and shall conform to ASTM D6690 Type IV and the following specifications:

Cone Penetration	90-150
Flow @ 60°C [140ºF]	3.0mm [1/8 in] max
Bond, non-immersed	Three 12.7mm [½ in] specimens pass 3 cycles @ 200% extension @ -29°C [-20ºF]
Resilience, %	60 min
Asphalt Compatibility, ASTM D5329	pass*

* There shall be no failure in adhesion, formation of any oily exudate at the interface between the sealant and asphaltic concrete or other deleterious effects on the asphaltic concrete or sealant when tested at 60°C [140ºF].

The contractor shall provide the Resident or authorized representative with a copy of the material manufacturer's recommendations pertaining to heating, application, and reheating prior to the beginning of operations or the changing of materials.

Section 401.03 Composition of Mixtures

Section 401.03 is deleted in its entirety and replaced with the following:

HMA pavement mixtures for local road and bridge projects shall be a currently approved MDOT design.

HMA pavement mixtures for Mainline paving projects shall conform to the following requirements:

The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. HMA shall be designed and tested according to AASHTO R35 and the volumetric criteria in Table 1. The Contractor shall size, uniformly grade, and combine the aggregate fractions in proportions that provide a mixture meeting the grading requirements of the Job Mix Formula (JMF). The Contractor may use a maximum of 15 percent reclaimed asphalt pavement (RAP) in any mainline surface course, and a maximum of 20 percent RAP in any base, intermediate, or shim course. Current MaineDOT approved designs with up to 20 percent RAP will be allowed on local roads.

The Contractor shall submit a job mix formula (JMF) developed for each specified mixture at least 30 days prior to placement.

The JMF shall establish a single percentage of aggregate passing each sieve size within the limits shown in Subsection 703.09. The mixture shall be designed and produced, including all production tolerances, to comply with the allowable control points for the particular type of mixture as outlined in Subsection 703.09. The JMF shall state the original source, gradation, and percentage to be used of each portion of the aggregate and mineral filler if required. It shall also state the proposed PGAB content, the name and location of the refiner, the supplier, the source of PGAB submitted for approval, the type of PGAB modification if applicable, and the location of the terminal if applicable.

In addition, the Contractor shall provide the following information with the proposed JMF:

- Properly completed JMF indicating all mix properties (Gmm, VMA, VFB, etc.).
- Stockpile Gradation Summary.
- Test reports for individual aggregate consensus properties
- Design Aggregate Structure Consensus Property Summary.
- Design Aggregate Structure Trial Blend Gradation Plots (0.45 power chart).
- Trial Blend Test Results for at least three different aggregate blends.
- Selected design aggregate blend.
- Test results for the selected design aggregate blend at a minimum of three binder contents.
- Test results for final selected blend compacted to $N_{max.}$
- Specific Gravity for the PGAB to be used.
- Recommended mixing and compaction temperatures from the PGAB supplier.
- Material Safety Data Sheets (MSDS) For PGAB.
- Asphalt Content vs. Air Voids trial blend curve.
- Test report for Contractor's Verification sample.
- Summary of RAP test results (if used), including count, average and standard deviation of binder content and gradation.

At the time of JMF submittal, the Contractor shall identify and make available the stockpiles of all proposed aggregates at the plant site. There must be a minimum of 150 ton for stone stockpiles, 75 ton for sand stockpiles, and 50 ton of blend sand before the Authority will sample. The Authority shall obtain samples for laboratory testing. The Contractor shall also make available to the Authority the PGAB proposed for use in the mix in sufficient quantity to test the properties of the asphalt and to produce samples for testing of the mixture. Before the start of paving, the Contractor and the Authority shall split a production sample for evaluation. The Contractor shall test its split of the sample and determine if the results meet the requirements. If the results are found to be acceptable, the Contractor will forward their results to the Authority's Lab, which will test the Authority's split of the sample. The results of the two split samples will be compared and shared between the Authority and the Contractor. If the Authority finds the mixture acceptable, an approved JMF will be forwarded to the Contractor. The Authority will then notify the Contractor that paving may commence. The first day's production shall be monitored, and the approval may be withdrawn if the mixture exhibits undesirable characteristics such as checking, shoving or displacement. The Contractor shall be allowed to submit aim changes within 24 hours of receipt of the first Acceptance test result for an individual JMF. Adjustments will be

allowed of up to 2% on the percent passing the 2.36 mm sieve through the 0.075 mm and 3% on the percent passing the 4.75 mm or larger sieves. Adjustments will be allowed on the %PGAB of up to 0.2 percent. Adjustments will be allowed on GMM of up to 0.010.

The Contractor shall submit a new JMF for approval each time a change in material source or materials properties is proposed. The same approval process shall be followed. The cold feed percentage of any aggregate except natural sand may be adjusted up to 10 percentage points from the amount listed on the JMF, however no aggregate listed on the JMF shall be eliminated. Natural sand may be adjusted up to 5 percent from the amount listed on the JMF but shall not exceed 13% by weight of total aggregates. The cold feed percentage for RAP may be reduced up to five percentage points from the amount listed on the JMF and shall not exceed the percentage of RAP approved in the JMF or for the specific application.

TABLE 1
VOLUMETRIC DESIGN CRITERIA

Design ESAL's (Millions)	Required Density (Percent of G_{mm})			Voids in the Mineral Aggregate (VMA)(Minimum Percent) Nominal Maximum Aggregate Size (mm)				Voids Filled with Binder (VFB) (Minimum %)	Fines/Eff. Binder Ratio
	$N_{initial}$	N_{design}	N_{max}	19	12.5	9.5	4.75		
10 to <30	≤89.0	96.0	≤98.0	13.5	14.5	15.5	15.5	65-80*	0.6-1.2

** For 9.5 mm nominal maximum aggregate size mixtures, the maximum VFB is 82.*

** For 4.75 mm nominal maximum aggregate size mixtures, the maximum VFB is 84.*

** For 4.75mm nominal maximum aggregate size mixtures, the Fines/Effective Binder Ratio is 0.6-1.4*

As part of the JMF submittal, there are Hamburg Wheel Tracker requirements, the Contractor shall provide the Authority the test results in accordance with AASHTO T324. The results shall be generated by a third party independent testing laboratory as approved by the Authority. The test results shall meet the requirements of Table 1A

TABLE 1A
HAMBURG WHEEL TRACKER REQUIREMENTS

Specified PG Binder Grade	Test Temperature (ºC)	Maximum Rut Depth (mm)	Minimum Number of Passes	Minimum Allowable SIP*
64-28	45	12.5	20,000	15,000
64E-28	45	8.0	20,000	15,000
70E-34	45	6.3	20,000	15,000

* As calculated by the most recently published version of the Maine DOT HWT worksheet, which is available online at http://www.maine.gov/mdot/contractors/publications/

Section 401.08 Hauling Equipment Trucks for Hauling HMA

Add the following paragraph:

The undercarriage of haul units actively hauling HMA to the site shall be relatively free of dust / mud agglomerations. Haul units found to be contaminating the paving surface shall be removed from the site and cleaned prior to returning.

Section 401.091 Material Transfer Vehicle (MTV)

The fourth paragraph shall be deleted and replaced with:

The MTV shall be designed so that the mix receives additional mixing action.

Section 401.165 Longitudinal Joint Density

The first paragraph shall be deleted and replaced with:

When noted in Special Provision Section 403, the Authority will measure the pavement density of longitudinal joints between adjoining mainline travel lanes in both the unconfined and confined condition as determined by the days paving operation.

The eighth paragraph shall be deleted and replaced with:

The minimum density of the completed pavement shall be 92.0 percent of the theoretical maximum density obtained. Two consecutive failing tests shall result in production shut down. Prior to resuming paving operations, the contractor quality control unit shall satisfy the Authority that the paving operation will produce joint densities in compliance with the Specifications.

The eleventh paragraph and associated table shall be deleted and replaced with:

Payment reduction will be applied to each sublot that has a density lower than 92.0% as outlined below.

PERCENT COMPACTION	PERCENT PAY
92.0 or greater	100
91.9 to 90.0	95
89.9 or less	90

Section 401.17 Joints

The fourth paragraph shall be deleted and replaced with:

When required by Special Provision Section 403, Mainline Longitudinal joints shall be constructed as notched-wedge joint and constructed in a manner that will best ensure joint integrity.

Section 401.18 Quality Control

The following shall be added to section c. Quality Control Technician(s) QCT:

The QCT shall be on site during paving operations performing quality control activities. QCT's shall not act as equipment operators or laborers.

Section 401.191 Inspection/Testing

In paragraph nine delete and replace Item #8 with:

8. Secure High Speed Internet Access

SPECIAL PROVISION

SECTION 403

HOT MIX ASPHALT PAVEMENT

403.01 Description

This work shall also consist of the construction, maintenance and removal of all temporary bituminous ramps at locations as shown on the Plans or as directed by the Resident.

403.02 General

The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. The Performance Graded Asphalt Binder (PGAB) shall be polymer modified as detailed in this special provision and shall conform to the requirements of AASHTO M 320. The PG64E-28 Binder shall contain a minimum of 2.5% Styrene-Butadiene-Styrene (SBS) polymer {BWT} in a homogeneous blend. The stability of the modified binder shall be verified in accordance with ATSM D7173 using the Dynamic Shear Rheometer (DSR). The DSR G*/sin(δ) results from the top and bottom sections of the ATSM D7173 test shall not differ by more than 10%. The results of ASTM D7173 shall be included on the Certified Test Report. The binder shall meet the requirements of AASHTO M 332 (including Appendix X1).

403.03 Construction

All areas which have been milled or overlaid shall have a minimum lengh temporary ramp constructed as determined by the Resident at the milled or overlaid limits prior to opening the roadway to traffic. Temporary ramps shall be constructed using the same material as being placed on that day or as directed by the Resident. All temporary ramps are to be constructed on a sand joint. The Contractor shall be responsible for all repairs and maintenance required for the temporary ramps.

The Contractor shall be responsible for the layout of the longitudinal centerline between the travel lanes.

The sand and loose debris adjacent to the median guardrail shall be removed and disposed of by the Contractor off of Turnpike property.

The forty-five degree pavement safety edge needed between lanes 1 and 2 shall be incidental to the 202 pay items.

A minimum test strip of 100 tons placed at a nominal depth of 1 ½ inches, full lane width, shall be required. It shall be evaluated under testing requirements for mix volumetric and density. The exact location will be identified by the Authority. Prior to placement of the test strip, a leveling course (Item 403.211) shall be placed at the chosen location. A fog coat of Item 409.15, Bituminous Tack Coat, shall be applied to the level course prior to the placement of the HMA surface course, payment to be made under the 409.15 pay item. The test strip will be excluded from the remainder of the projects' QA analysis. The Contractor shall notify the Authority at least 48 hours in advance of placing the test strip. The test strip is intended to allow

the Contractor to establish a method of compaction and adjust plant settings prior to mainline plant production.

403.04 Method of Measurement

The construction and removal of temporary ramps on sand joints, and maintaining the ramps will not be measured separately for payment, but shall be incidental to Items 403.

The removal of sand and loose debris will not be measured separately for payment, but shall be incidental to paving items.

Hot Mix Asphalt, 12.5 mm (Polymer Modified pavement with (up to) 15% RAP, placed as a wearing surface will be measured under Item 403.2081 Hot Mix Asphalt, 12.5 mm (Polymer Modified) - RAP.

403.05 Basis of Payment

Hot Mix Asphalt, 12.5 mm (Polymer Modified) pavement with (up to) 15% RAP, placed as a wearing surface will be paid under Item 403.2081 Hot Mix Asphalt, 12.5 mm (Polymer Modified) – RAP.

The following pay items are added:

Pay Item		Pay Unit
403.2081	Hot Mix Asphalt, 12.5 mm (Polymer Modified) – RAP	Ton
403.2084	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (sidewalks, drives, Islands & incidentals)	Ton

SPECIAL PROVISION

SECTION 403

HOT MIX ASPHALT PAVEMENT

Course	HMA Grading	Item Number	Total Thickness	No. of Layers	Complimentary Notes
Southbound and Northbound Service Plazas- Full Depth Construction					
Wearing	**12.5mm**	**403.208**	**1.5”**	**1**	**B,C2,E,J,L,N**
Intermediate	**12.5mm**	**403.213**	**1.5”**	**1**	**B,C2,E,J,L,N**
Base	**19.0 mm**	**403.207**	**2.5**	**1**	**B,C2,E,J,L,N**

COMPLEMENTARY NOTES

A. The required PGAB for this mixture shall be **64E-28.**
B. The required PGAB for this mixture shall be **64-28.**
C1. A maximum of 15 percent RAP may be used.
C2. A maximum of 20 percent RAP may be used.
D. RAP may not be used.
E. The Maine DOT will conduct the job mix verification. The aggregate qualities shall meet the design traffic level of 3 to <10 million ESALS for mix placed under this contract. The design verification, Quality Control, and Acceptance tests for this mix will be performed at **XX gyrations**. (N design) Minimum and Maximum PGAB content shall not apply.
F. The MTA will conduct the job mix verification. The aggregate qualities shall meet the design traffic level of 10 to <30 million ESALS for mix placed under this contract. The design verification, Quality Control, and Acceptance tests for this mix will be performed at **75 gyrations**. (N design)
G. A material transfer vehicle (MTV) shall be used for the placement of Hot Mix Asphalt wearing surface on all roadways including acceleration and deceleration lanes and all ramps.
H. Joints shall be constructed as the “notched wedge” type in accordance with Subsection 401.17.
I. Joint density will be measured in accordance with Subsection 401.165.
J. Tack coat shall be applied between all layers of pavement at a rate of 0.04 G/SY.
K. PGAB shall conform to the provisions of 403.02 – Polymer Modified PGAB for HMA
L. The contractor shall furnish a quality control technician equipped with an approved densometer to ensure density requirements are met.
M. Hydrated Lime shall be incorporated into the mixture.
N. No vehicular loads shall be permitted on newly completed pavement until adequate stability has been attained and the material has cooled sufficiently to prevent distortion or loss of fines. The newly paved area may be opened to traffic after the internal temperature of the pavement has cooled to 120° F. The Resident will test the internal temperature of the pavement and shall be the sole judge as to the opening to traffic. The period of time before opening to traffic may be extended at the discretion of the Resident. The lane closure may not be removed until the internal temperature has cooled to 120° F.

SPECIAL PROVISION

SECTION 409

BITUMINOUS TACK COAT

409.02 Bituminous Material

This Subsection is deleted and replaced with the following:

Bituminous material shall conform to the Specifications for Emulsified Asphalt RS-1h, of the AASHTO Designation M-140.

409.05 Equipment

Add "or as determined by the Resident", after the words "gal/yd^2]" in the fourth line of the second paragraph of this Subsection.

409.06 Preparation of Surface

The following paragraph is added:

All existing pavement and shoulder areas on which bituminous concrete mixtures are to be placed shall receive a tack coat. The surface area where the tack coat is to be applied shall be dry and cleaned of all dirt, sand, and loose material. Cleaning shall be accomplished by use of revolving brooms or mechanical sweepers. Undesirable material not removed by the above means shall be cleaned by hand sweeping or scraping, or a combination of both. Small areas otherwise inaccessible may be swept with hand brooms. The tack coat shall be applied only when the existing surface is dry.

409.08 Method of Measurement

The following paragraphs are added:

Measurement will be based on delivery slips made out in duplicate by the Contractor and signed by the Resident, or his representative, at the point of delivery. One of these slips shall be retained by the Resident and one by the Contractor. Delivery slips shall be furnished by the Contractor and shall provide space for identifying the vehicle and driver, for stating the volume of material carried, the source of the material, the date, and the Resident or his representative's signature.

Material included in the delivery slips and not used or rejected shall be deducted from the amount being measured for payment. Each day's delivery slips shall be reconciled by the Contractor and the Resident within 24-hours.

Cleaning of the surface area where tack coat is to be applied shall be incidental to Item 409.15, Bituminous Tack Coat - Applied.

409.09 Basis of Payment

The following pay items are added:

Pay Item		Pay Unit
409.15	Bituminous Tack Coat – Applied	Gallon

SPECIAL PROVISION

SECTION 419

SAWING AND SEALING JOINTS IN BITUMINOUS PAVEMENT

(Sawing Bituminous Pavement)

419.01 Description

This work consists of sawing bituminous concrete pavement as shown on the Plans, as specified herein or as approved by the Resident.

419.02 General

The bituminous concrete pavement to be sawed shall be accurately marked before cutting. The marking shall be in accordance with the locations as shown on the Plans or as approved by the Resident. Cutting shall be with an approved power driven saw with an abrasive blade.

Unless otherwise noted or directed, the sawcut shall be vertical, a minimum of 3/8 inch wide, and extend to the depth as shown on the Plans.

Residue or debris from the sawing operation shall be removed immediately and legally disposed of by the Contractor.

419.03 Method of Measurement

Sawing Bituminous Pavement will be measured by the linear foot of pavement actually cut and accepted. No additional payment will be made for variations in the pavement thickness.

419.04 Basis of Payment

Sawing Bituminous Pavement will be paid for at the Contract unit price per linear foot which shall be full compensation for all materials, tools, equipment labor, and all incidentals necessary for the completion of the work to the satisfaction of the Resident. The disposal of sawcut residue shall be incidental to this item.

Payment will be made under:

Pay Item		Pay Unit
419.30	Sawing Bituminous Pavement	Linear Foot

SPECIAL PROVISION

SECTION 502

STRUCTURAL CONCRETE

(Concrete Gas Island and Slab)
(Concrete Diesel Island and Slab)
(Concrete Gas and Diesel Tank Slabs)
(Concrete Fuel Tank Slab)

502.01 Description

The following paragraph is added:

This work shall consist of furnishing and placing Portland Cement Concrete for the fuel system islands and slabs, and fuel tank slabs in accordance with these Specifications and in conformity with the lines, grades, and dimensions shown on the Plans.

All exposed surfaces shall be coated with a clear penetrating sealer meeting the requirements of Section 515.

502.18 Method of Measurement

The following sentences are added:

Concrete for Concrete Gas Island and Slab satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the dimensions shown on the Plans or authorized changes in the Plans.

Concrete for Concrete Diesel Island and Slab satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the dimensions shown on the Plans or authorized changes in the Plans.

Concrete for Concrete Gas and Diesel Tank Slabs satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the dimensions shown on the Plans or authorized changes in the Plans.

Concrete for Concrete Fuel Tank Slab satisfactorily placed and accepted will be measured by the cubic yard, in accordance with the dimensions shown on the Plans or authorized changes in the Plans.

502.19 Basis of Payment

The following paragraphs are added:

The accepted work completed for Concrete Gas Island and Slab will be paid for at the Contract unit price per cubic yard. Payment shall be full compensation for furnishing all materials,

expansion joint filler, bonding, curing, and joint sealing and all incidentals necessary to complete the work.

The accepted work completed for Concrete for Concrete Diesel Island and Slab will be paid for at the Contract unit price per cubic yard. Payment shall be full compensation for furnishing all materials, expansion joint filler, bonding, curing, and joint sealing and all incidentals necessary to complete the work.

The accepted work done for Concrete Gas and Diesel Tank Slabs will be paid for at the Contract unit price per cubic yard. Payment shall be full compensation for furnishing all materials, expansion joint filler, bonding, curing, and joint sealing, protective coating and all incidentals necessary to complete the work.

The accepted work done for Concrete Fuel Tank Slab will be paid for at the Contract unit price per cubic yard. Payment shall be full compensation for furnishing all materials, expansion joint filler, bonding, curing, and joint sealing, protective coating and all incidentals necessary to complete the work.

Reinforcing steel will be paid for separately in accordance with Section 503, Reinforcing Steel.

Protective coating will not be measured for payment but will be incidental to Concrete Slab items.

All costs associated with obtaining, testing and evaluating drilled specimens for dispute resolution will not be paid for separately, but shall be considered incidental to the related items.

Payment will be made under:

Pay Item		Pay Unit
502.701	Concrete Gas Island and Slab	Cubic Yard
502.702	Concrete Diesel Island and Slab	Cubic Yard
502.703	Concrete Gas Tank Slab	Cubic Yard
502.704	Concrete Diesel Tank Slab	Cubic Yard
502.705	Concrete Fuel Tank Slab	Cubic Yard

SPECIAL PROVISION

SECTION 515

PROTECTIVE COATING FOR CONCRETE SURFACES

(Clear Concrete Protective Coating)

Section 515, Protective Coating for Concrete Surfaces, is deleted in its entirety and replaced with the following:

515.01 Description

The work shall include the surface preparation and application of a clear protective coating on concrete surfaces to protect new cast-in-place concrete, precast concrete and masonry structures. The coating system shall be applied to islands and slabs in accordance with the Plans, Specifications and the manufacturer's published recommendations.

515.02 Materials

The penetrating sealer shall be StandOff® SLX100 Water & Oil Repellent, as manufactured by ProSoCo, Inc., or an approved equal. The sealer shall have the following properties:

Active Substance:	modified alkyl alkoxy silane
Active Content:	> 90%
Form:	clear liquid
VOC:	< 3.5 pounds per gallon

The product shall comply with regulations limiting the Volatile Organic Compound (VOC) content of architectural and industrial maintenance coatings.

The Contractor shall submit the ProSoCo's product data sheets, material safety data sheets and recommended instructions for application of the StandOff® SLX100.

Materials shall be delivered to the site in original packages or containers bearing the manufacturer's labels and identification.

515.021 Substitute Materials

The Contractor shall submit a written request for approval of proposed substitute material naming the proposed manufacturer and product. This request shall be accompanied by:

1. Test data from an independent testing laboratory stating that the proposed substitute meets or exceeds the specified requirements as listed and has been tested in accordance with the specified test standards.

2. Documentation that the proposed material has a proven record of performance when used in the intended application as confirmed by actual field tests and successful installations in place on at least five similar projects.

3. Certification that if two or more types of products are intended to be used as part of a system, they will be supplied by the same manufacturer to ensure compatibility of materials, and to maintain single source manufacturer responsibility.

The Resident reserves the right to require additional testing to evaluate any proposed substitute product at no additional cost to the Authority. The Resident's decision as to the acceptability or non-acceptability of the proposed product shall be final.

515.03 Surface Preparation

All caulking, patching, and joint sealant shall be installed prior to application of the sealer. On new surfaces to be treated, all voids shall be dressed by dry rubbing to remove form marks and blemishes to present a neat appearance. Concrete and masonry surfaces shall be cleaned free of dust, surface dirt, oil, efflorescence and contaminants to ensure penetration of the sealer. The surface may be slightly damp at the time of treatment.

The Contractor may use, when required, appropriate cleaning materials recommended by the sealer manufacturer in conjunction with high pressure water for cleaning the concrete or masonry.

515.04 Application

The Contractor shall apply the clear concrete protective coating in strict accordance with the manufacturer's published recommendations.

The application shall not be conducted when surface and air temperatures are below 40^{o}F or above 90^{o}F. The work shall not be conducted when there is a chance of the surface temperature falling below 40^{o}F in the 24-hours following application; nor should it be applied on hot, windy days.

The treatment shall not be applied during rain to wet surfaces or when there is a chance of rain within 24-hours after application. After treatment, surfaces should be protected from rain for not less than 48-hours. It shall not be applied when winds are sufficient to carry airborne chemicals to unprotected surfaces.

Prior to applying the sealer, the Contractor shall protect all surrounding non-masonry/non-concrete surfaces, landscape and lawn areas, and surfaces not designated for treatment, from contact with the penetrating sealer, and prevent overspray of the penetrating sealer caused by wind drift.

The Contractor shall ensure that all safety equipment, facilities and precautions recommended by the product manufacturer are furnished and/or strictly adhered to.

The sealer material shall be applied in the manner and with the equipment recommended by the product manufacturer. Coverage will vary depending on condition, texture and porosity of the surfaces. Pre-testing is required.

Sealer shall be applied as packaged without dilution or alteration. The sealer shall be applied with low pressure (20 psi) airless spray equipment or with a heavily saturated brush or roller unless otherwise permitted by the Resident. Sufficient material shall be applied to thoroughly saturate the surface making sure to brush out excess material that does not penetrate.

When the sealer is applied to horizontal surfaces, it shall be applied in a single saturating application with sufficient material and applied so the surface remains wet for one to two minutes before penetration into the concrete. Surface residues, pools and puddles shall be broomed-out thoroughly until they completely penetrate into the surface.

When the sealer is applied to vertical and sloped surfaces, it shall be applied in a "wet-on-wet" application for best results on most porous materials. In the case of extremely dense concrete, it may be necessary to restrict the amount of material applied to one saturating application in order to prevent surface darkening. Apply from the bottom up with sufficient material to thoroughly coat the surface and create a slight rundown below the spray pattern. Allow the first application to penetrate the concrete surface, and within a few minutes after the first coat appears dry, reapply in the same saturating manner.

When the sealer is applied to vertical and sloped surfaces, it shall be applied in two applications, 10 minutes apart, with a low pressure (20 psi) airless sprayer.

515.05 Method of Measurement

Clear Protective Coating for Concrete Surfaces will not be measured separately for payment, but shall be incidental to the applicable Section 502 gas and diesel islands and slabs pay items.

SPECIAL PROVISION

SECTION 526

CONCRETE BARRIER

(Temporary Concrete Barrier Type I - Supplied by Authority)

526.01 Description

The following paragraphs are added:

This work shall consist of loading, transporting, setting, resetting, removing, transporting and stacking Temporary Concrete Barrier Type I – Supplied by Authority. The barrier shall have attachments allowing individual sections to be connected into a continuous barrier.

The work also includes supplying connecting pins and furnishing and mounting retro-reflective delineators, per Subsection 526.02 and 526.03.

Concrete barriers supplied by Authority shall be available at the following location(s):

Maintenance Area	Linear Feet of Barrier
Kennebunk Maintenance Area Mile 25.3	1,350

Upon substantial completion of work, the Contractor shall remove and transport the barrier back to its maintenance area of origin. All barrier shall be returned, sorted and stacked according to type in locations directed by the project Resident or maintenance area foreman.

526.02 Materials

The following paragraphs are added:

e. Delineators shall be bi-directional with a minimum effective reflective area of eight square inches as approved by the Resident. The reflectors shall be methyl methacrylate and the housing of acrylonitrile butadiene styrene. Color shall be in accordance with the MUTCD.

526.021 Acceptance

The Resident shall have the authority to accept or reject all Temporary Concrete Barrier Type I – Supplied by Authority used on the Project that does not meet the requirements of this specification

526.03 Construction Requirements

The following paragraphs are added:

The Contractor shall notify the Resident prior to the scheduled pick-up and delivery of concrete barrier. No barrier shall be removed from or stacked at the Turnpike Maintenance Area without approval of the Resident.

The Contractor shall move and place barrier-utilizing methods that will not damage the barrier. Barrier that is damaged by the Contractor by failing to use proper methods shall be replaced by the Contractor at no additional cost to the Maine Turnpike Authority.

Concrete barrier supplied by the Authority consists of several different styles. Not all barriers may be compatible. The Contractor shall utilize caution when setting barrier to use identical barrier types as adjacent barrier. Non-compatible barrier that cannot be attached together shall be overlapped by a minimum of 10 feet with the blunt end on the non-traffic side of the barrier. This work will not be measured separately for payment, but shall be incidental to the concrete barrier.

Concrete barrier placed at roadway low points shall be shimmed on 1" by 2" by 2' long wood planks to allow drainage to pass under the barrier. In addition, the Resident may direct the Contractor to shim the concrete barrier at other locations to provide for proper roadway drainage. All labor, material, and equipment necessary to shim the barrier will not be measured separately for payment, but shall be incidental to the Concrete Barrier.

The removal of concrete barrier from adjacent to the travel lane may be conducted without a lane closure if it is accomplished in accordance with the following requirements:

1. Barrier is removed from the trailing end and the workmen and equipment involved in the operation are always behind the barrier. No workmen or equipment shall enter the travel lane.
2. Barrier shall be dragged away from the travel lane to at least a 30-degree angle by the use of a cable.
3. Barrier shall be lifted no more than six inches while within 10 feet of the travel lane.

Retro-Reflective Delineators shall be mounted as follows:

4. One on top of each barrier.
5. One on the traffic side of every barrier used in a taper.
6. One on the traffic side of every other barrier at regularly spaced intervals and locations.
7. Delineators shall be installed on both sides of the barrier if barrier is used to separate opposing traffic.
8. Delineators shall be physically adhered so as to withstand the force of throw from a snow plow.
9. If more than 25% of delineators in any 50 foot section of barrier fall off for any reason, the Contractor will be responsible for reinstalling all the delineators in that run at that their own cost.
10. Contractor is required to submit the installation method for review and approval to the Resident.

526.04 Method of Measurement

The following paragraphs are added:

Temporary Concrete Barrier Type I – Supplied by Authority shall be measured for payment by the lump sum.

The loading, transporting, setting, resetting, removing, transporting, sorting and stacking of the barrier, the furnishing, installation and maintenance of the barrier delineators, and furnishing and installing connector pins will not be measured separately for payment, but shall be incidental to the cost of the Barrier. Temporary storage of Concrete Barrier between construction phases, if required, will not be measured separately for payment, but shall be incidental to the cost of the Barrier. All equipment required to load, unload, transport and stack Concrete Barrier shall be supplied by the Contractor.

Any Barrier lost or damaged by the Contractor shall be replaced by the Contractor at no additional cost to the Authority.

526.05 Basis of Payment

The fifth paragraph is deleted and not replaced.

The following paragraphs are added:

Temporary Concrete Barrier Type I – Supplied by Authority will be paid for at the Contract lump sum price, complete in place. Such payment shall be full compensation for loading, transporting, setting, resetting, temporary storage, removing, transporting and stacking at the area designated, furnishing all materials, and all other incidentals necessary to complete the work. Temporary Concrete Barrier Type I – Supplied by Authority and all connecting pins shall remain the property of the Authority, and shall be returned to the Turnpike Maintenance Area as designated in Subsection 526.01.

Payment of Concrete Barrier shall be based on a percentage of the work accomplished during that pay period.

Payment will be made under:

Pay Item		Pay Unit
526.306	Temporary Concrete Barrier, Type I – Supplied by Authority	Lump Sum

SPECIAL PROVISION

SECTION 527

ENERGY ABSORBING UNIT

(Work Zone Crash Cushion)

527.01 Description

The first paragraph is deleted in its entirety and replaced with the following:

The Contractor shall furnish and install work zone crash cushions where shown on the Plans, as specified herein, in Special Provision 652, or as approved by the Resident. Work zone crash cushions are required at each exposed end of temporary concrete barrier or guardrail.

The exposed end of the concrete barrier within 30 feet of the mainline travel lane shall be protected at all times. Barrier shall not be reset until after the work zone crash cushion(s) has been set to protect the exposed end of the barrier.

527.02 Materials

The following paragraph is added:

Only work zone crash cushions meeting the NCHRP Report 350 TL-3 crash test requirements may be used on the turnpike and local roadways with posted speeds of 45 MPH or greater. Work zone crash cushions meeting the NCHRP Report 350 TL-2 crash test requirements may be used on local roadways with posted speeds of 40 MPH or less. The Contractor shall provide the Resident with documentation of the proposed work zone crash cushion's NCHRP Report 350 Crash Test Results prior to installation at the jobsite.

527.03 Construction Requirements

The following is added to the end of the first paragraph:

The design speeds for work zone crash cushions shall be 45 mph for local road and 70 mph for turnpike roadways unless otherwise noted on the Plans.

527.04 Method of Measurement

Work Zone Crash Cushions used to protect exposed ends of guardrail for steel girder erection will not be measured separately for payment, but shall be included under the Maintenance of Traffic for Steel Girder Erection item.

527.05 Basis of Payment

Payment will be made under:

Pay Item		Pay Unit
527.34	Work Zone Crash Cushions – TL-2	Unit
527.341	Work Zone Crash Cushions – TL-3	Unit

SPECIAL PROVISION

SECTION 603

PIPE CULVERTS AND STORM DRAINS

(Reinforced Concrete Pipe)
(Concrete Collar)
(Corrugated Polyethylene Pipe)

603.01 Description

The following paragraphs are added:

This work shall also consist of furnishing and installing Class III or Class V reinforced concrete pipe at the locations as shown on the Plans or as approved by the Resident.

This work also consists of furnishing and installing a concrete collar to join existing concrete pipe to the proposed concrete or Corrugated High Density Polyethylene (HDPE) pipe in accordance with the details as shown on the Plans. The Contractor shall note that the concrete pipe ends may be of different sizes and may not fit snugly together.

This work shall also consist of furnishing and installing various sizes of corrugated HDPE pipe, including a dual wall adaptor fitting by Hancor or an approved equal as shown on the plans. No other pipe types within the Option III alternatives will be accepted.

603.02 Materials

All Corrugated High Density Polyethylene (HDPE) pipe for storm water and drainage systems shall meet the requirements of Subsection 706.06.

603.11 Method of Measurement

The following paragraph is added:

The Concrete Collar shall be measured by each unit installed, complete in place and accepted. This shall be full compensation for furnishing labor and materials to construct a Concrete Collar to connect the existing and proposed pipe ends in a working like manner.

Dual Wall Adapter Fitting shall be included for payment as three additional linear feet of the largest pipe involved.

603.12 Basis of Payment

Concrete Collars will be paid for at the Contract unit price each regardless of the size of the existing and proposed pipes.

Corrugated HDPE pipe will be paid for under the appropriate sized Culvert Pipe Option III pay items

Payment will be made under:

Pay Item		Pay Unit
603.155	12 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.165	15 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.1653	15 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.175	18 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.1753	18 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.195	24 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.1953	24 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.205	30 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2053	30 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.215	36 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2153	36 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.225	42 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2253	42 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.235	48 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2353	48 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.245	54 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2453	54 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.255	60 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2553	60 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.265	66 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2653	66 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.275	72 inch Reinforced Concrete Pipe - Class III	Linear Foot
603.2753	72 inch Reinforced Concrete Pipe - Class V	Linear Foot
603.155	12 Inch Reinforced Concrete Pipe – Class III	Linear Foot
603.28	Concrete Collar	Each

SPECIAL PROVISION

SECTION 604

MANHOLES, INLETS, AND CATCH BASINS

(Oil-Water Separator System)

604.01 Description

This work shall include designing, furnishing and installing an oil-water separator system on the southbound and northbound service plazas. The oil-water separator system shall consist of a precast oil-water separator structure, PVC and RCP pipes, and four (4) precast manholes required to provide a complete functioning system as generally shown on the plans or as approved by the Resident. The system shown on the plans is for informational purposes only. The limits of the oil-water separator system will be from the manhole connecting to the upstream drainage system to the manhole connecting to the downstream drainage system. The manhole used to connect to the upstream drainage system shall include a baffle to allow bypass of high flow volumes.

The oil-water separator system shall tie into the existing upstream and downstream plaza drainage system as shown on the plans. The bypass pipe diameter shall not be smaller than the upstream drainage pipe diameter and the final outlet elevation shown on the plans shall be maintained.

The work shall also include connecting to the proposed drainage system as required, all testing, and all other work necessary to complete the construction, all in accordance with these Specifications, the conceptual layout and notes contained in the plans, or as directed by the Resident.

604.02 Materials

The following paragraphs are added:

PVC Pipe shall meet the requirements of Subsection 706.08.

Structures shall be heavy-traffic precast concrete manholes: ASTM C478 designed for HS-20-44, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints. Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.

Joint gaskets shall be rubber per ASTM C443 or a double bitumastic seal per ASTM C990.

Include two or three reinforced-concrete rings or brick masonry, minimum nine-inch total adjustment, with an opening that matches the structure access opening and the opening of the casting frame and cover.

Pipe connectors shall be per ASTM C923, resilient, of size required, for each pipe connecting to structures.

All frames and covers shall be cast iron conforming to the requirements of AASHTO M105 for Class No. 30 gray iron castings suitable for HS-20 - 44 loading. Frames and covers shall be machined to insure true bearing surfaces. Cover(s) for the oil-water separator shall be cast with the word "O/W SEP" on it. Frame flanges shall have a minimum four-inch width. Casting for oil-water separator shall have a minimum 30-inch clear opening.

Dampproofing for oil-water separator shall be cutback asphalt, AASHTO M81 or M82; asphalt emulsion AASHTO M140 or an approved equal. Two coats shall be applied at one half (1/2) gallon per square yard per coat minimum.

604.03 Construction Requirements

The following paragraphs are added:

The proposed oil-water separator system shall be designed and stamped by a Professional Engineer licensed in the State of Maine and submitted to the Authority for approval. The design shall be completed in accordance with the latest edition of the MaineDOT Standard Specifications and project-specific Special Provisions. The Contractor shall submit detailed plans for approval. The oil-water separator shall also be designed in accordance with the requirements of the Maine DEP Stormwater BMP Manual and shall have a minimum storage capacity of 400 cubic feet from the bottom of the separator to the invert of the outlet pipe.

The subgrade on which the structures are to be set shall be smooth and level and shall consist of a minimum of six-inch compacted bedding material leveling course. Before inlet or outlet pipes are connected, the excavation for the structures shall be backfilled to the level of the inlet and outlet pipes. After the inlet and outlet pipes have been installed and approved, the remainder of the backfill shall be placed. Castings shall be set flush with the finish grade.

604.05 Method of Measurement

The following sentence is added:

Oil-Water Separator System will be measured by the number of units, complete and accepted in place.

604.06 Basis of Payment

The following paragraphs are added:

The accepted quantity of Oil-Water Separator System will be paid for at the contract unit price each complete and place. Payment shall include the design, detailing, fabrication, delivery and installation as well as excavation, dewatering, shoring, bracing, sheeting, bedding, backfill, compaction, precast concrete manholes, steps, casting frames and covers, brick masonry, concrete, concrete adjustment collars, mortar, dampproofing, all piping and piping support systems and hardware within the structure, flexible watertight pipe connectors, testing, and all material, labor and tools incidental to the work which is required to construct a complete functional system.

Payment shall be full compensation for furnishing and installing and all incidental materials and equipment necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
604.30	Oil-Water Separator System	Lump Sum

SPECIAL PROVISION

SECTION 604

MANHOLES, INLETS, AND CATCH BASINS

(Catch Basin Type A1)

604.01 Description

This work shall include furnishing and installing catch basins type A1.

604.02 Materials

The following paragraphs are added:

Elastomeric sealer shall be Sikaflex 1a as manufactured by Sika or an approved equal.

Class AAA concrete shall conform to Subsection 502.05; except that the minimum cement factor shall be 750 pounds per cubic yard and the coarse aggregate size shall conform to ASTM C33 Grading 7.

The third paragraph should be deleted and replaced with:

Catch Basin Frames and Grates shall be as outlined below and be manufactured by EJ Company of Brockton, Massachusetts or an approved equal and shall meet or exceed the AASHTO M306 Loading Requirements.

Catch Basin Frames shall be manufactured by EJ Company of Brockton, Massachusetts (or an approved equal) with the following product numbers:

5521Z - 8 Inch Frame Product Number 00552111
5546Z – 6 Inch Frame Product Number 00554611
5544Z - 4 Inch Frame Product Number 00554411

Catch Basin Frames shall be 8” frames unless otherwise specified by the plans or approved by the resident.

Catch Basin Grates shall be a square holed grate as manufactured by EJ Company of Brockton, Massachusetts (or an approved equal) with the following product number:

5520M5 Grate Product Number 00552060

If a cascade catch basin grate is specified on the plans then it shall be manufactured by EJ Company of Brockton, Massachusetts (or an approved equal) with the following product numbers depending on the direction of flow:

5520M8 Product Number 00552084 or 5520M8 Product Number 00552085

670.16 Basis of Payment

Payment will be made under:

Pay Item		Pay Unit
604.071	Catch Basin Type A1	Each

SPECIAL PROVISION

SECTION 607

FENCES

(6 Foot Chain Link Safety Fence)

607.01 Description

The following paragraph is added:

The work shall consist of the construction of a free standing six foot chain link safety fence, in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Plans or established the Resident. The construction of the safety fence shall include furnishing, erection, maintaining, removing and resetting, and removal of the fence from the jobsite at the completion of the Project as directed by the Resident.

607.02 Materials

The following sentence is added:

The fence shall be a free standing six foot chain link fence by National Construction Rentals (Telephone number 1-800-352-5675), or an approved equal.

Contractor will submit drawings showing major components of the fencing and methods of support for approval.

607.07 Basis of Payment

Payment will be made under:

Pay Item		Pay Unit
607.18	6 Foot Chain Link Safety Fence	Linear Foot

SPECIAL PROVISION

SECTION 608

SIDEWALKS

(Reinforced Concrete Sidewalk)

608.03 Portland Cement Concrete Sidewalks

The last paragraph in Subsection "e. Joints" is deleted and replaced with the following:

No pre-formed joint filler is required between the sidewalks and the granite curb. A preformed joint filler is required between the sidewalks and all other fixed structures in addition to expansion joints every 48 feet (maximum) of sidewalk. A sawed joint (1" depth x 1/8"wide) shall be constructed every six feet or as shown on Plans.

A preformed joint filler 1/2" thick shall be used at the expansion joints. The sawed joint shall be cut within 12-hours of placement of the concrete and shall be filled with Sika 1A after the concrete has cured for 14 days.

The following paragraph is added:

g. Sealing All exposed surfaces shall be coated with a clear penetrating sealer meeting the requirements of Section 515.

608.06 Basis of Payment

The following sentence is added:

Clear penetrating sealer will not be measured for payment but will be incidental to Reinforced Concrete Sidewalk pay item.

SPECIAL PROVISION

SECTION 613

EROSION CONTROL BLANKET

613.01 Description

This work shall also include seeding, mulching and watering the median swale and/or longitudinal flow line to the limits and width as shown on the Plans or as directed by the Resident.

613.02 Materials

The following sentences are added:

Seeding shall meet the requirements of Section 618, Seeding, Method Number 2.

Mulch shall meet the requirements of Section 619.

The following Subsection is added:

613.041 Maintenance and Acceptance

See Section 618.10 for maintenance and acceptance of seeding.

613.042 Mulch

All mulch shall be placed after the area has been seeded and prior to the installation of the Erosion Control Blanket.

613.09 Basis of Payment

The following "and mulch" is added after the words "initial seeding" in the second sentence.

SPECIAL PROVISION

SECTION 619

MULCH

(Mulch – Plan Quantity)
(Temporary Mulch)

619.01 Description

The first paragraph is modified by the addition of the following:

"as a temporary or permanent erosion control measure" after the word "mulch".

Add the following sentence at the end of the first paragraph:

Refer to Section 656 Temporary Soil and Water Pollution Control, for more information on Temporary Mulch.

619.03 General

The first paragraph is deleted and replaced with the following:

Cellulose fiber mulch shall not be used within 200 feet of a wetland or stream. The limits shall be 200 feet up station and down station of the wetland or streams as well as the slopes adjacent to the stream. The application of hay or straw mulch with an approved binder shall be used at these locations to prevent erosion.

The use of cellulose fiber mulch will only be allowed at other areas with the approval of the Resident. The Contractor may be required to demonstrate that the material may be applied in a manner that will prevent erosion and will aid in the establishment of permanent vegetation. The Resident reserves the right to require the use of hay or straw mulch at all locations if he determines that the cellulose mulch is ineffective. Cellulose fiber mulch is not acceptable for winter stabilization.

610.06 Method of Measurement

The following sentence is added:

Temporary Mulch will be paid for by the lump sum.

656.10 Basis of Payment

Temporary Mulch will be paid for at the Contract price per lump sum which shall be full compensation for furnishing and spreading the Temporary Mulch as many times as necessary as determined by the Contractor's operations and staging. The price shall also include the additional mulch netting and snow removal necessary during the winter months.

Payment will be made under:

Pay Item		Pay Unit
619.1201	Mulch – Plan Quantity	Unit
619.1202	Temporary Mulch	Lump Sum

SPECIAL PROVISION

SECTION 626

FOUNDATIONS, CONDUIT, AND JUNCTION BOXES
FOR HIGHWAY SIGNING, LIGHTING AND SIGNALS

(Quazite Junction Box 18 x 12)

626.02 General

The following paragraph is added:

Junction boxes for the electrical associated with highway lighting shall be polymer concrete as manufactured by QUAZITE® a division of Hubbell Power Systems. The boxes shall be 18" x 12" and 18" deep. All existing Junction Boxes in useable condition shall be removed and relocated as directed by the Resident Engineer. New boxes shall have the words MTA LIGHTING stamped on the cover. The boxes shall have a 15,000 lb. load rating.

626.04 Method of Measurement

The following sentences are added:

Quazite junction box shall be measured by each unit in place and accepted existing or new.

626.05 Basis of Payment

The words, "polymer concrete" shall be added after the words, "precast concrete" in the second sentence of the second paragraph.

Payment will be made under:

Pay Item		Pay Unit
626.13	18" x 12" x 18" Quazite Junction Box	Each

SPECIAL PROVISION

SECTION 627

PAVEMENT MARKINGS

(Temporary 6 Inch Pavement Marking Tape)
(Temporary 6 Inch Black Pavement Marking Tape)

627.01 Description

The following sentence is added:

This work shall also consist of furnishing, placing, maintaining and removing temporary pavement marking tape at locations shown on the Plans or as directed by the Resident.

This work shall also consist of furnishing, placing, maintaining and removing temporary black pavement marking tape at locations shown on the Plans or as directed by the Resident. Temporary 6 Inch Black Pavement Marking Tape shall be used to cover conflicting existing pavement marking paint.

627.02 Materials

The following paragraph is added:

Temporary pavement marking tape shall be Stamark Wet Reflective Removable Pavement Marking Tape Series 710 as manufactured by 3M of St. Paul, Minnesota or an approved equal.

Temporary pavement marking tape shall be Stamark Removable Black Line Mask Tape Series 715 as manufactured by 3M of St. Paul, Minnesota or an approved equal.

627.04 General

The following paragraphs are added:

Work under this item shall be in accordance with the manufacturer's recommendations. A factory representative from 3M shall be present for the first application of all temporary pavement marking tape to insure proper application and product performance.

The pavement markings shall be applied mechanically to clean dry pavement as recommended by the manufacturer and approved by the Resident.

Temporary pavement markings shall consist of applying six inch solid white, six inch broken white, and six inch yellow reflectorized pavement marking tape for traffic maintenance during construction as shown on the Plans or as directed by the Resident.

Temporary pavement marking tape that loses reflectivity, becomes broken, dislodged or missing during the life of the Contract shall be replaced by the Contractor at no additional cost to

the Authority.

627.06 Application

The following paragraphs are added:

For application of the tape, when the pavement temperature is below 50$_{o}$F, heat shall be applied to the pavement surface, if deemed necessary by the factory representative or as directed by the Resident, at no additional cost to the Authority. Proper primer for the temperatures shall be used as directed by the manufacture.

The pavement mark tape shall be rolled over with a vehicle once application is complete and then scored every 20 feet when placed in long runs to prevent full length unraveling.

627.08 Removing Lines and Markings

The following sentence is added:

Removal of temporary pavement marking tape shall be accomplished without the use of heat, solvents, grinding or sandblasting and in such a manner that no damage to the pavement results.

627.09 Method of Measurement

The following paragraph is added:

Temporary Pavement Markings - Tape will be measured for payment by the linear foot. The measurement of broken lines will not include the gaps.

627.10 Basis of Payment

The following paragraphs are added:

Payment for the Temporary Pavement Markings - Tape will be made at the Contract bid price per linear foot, which price shall include furnishing, installing, maintaining and removing the temporary tape and all materials, labor, equipment and incidentals necessary to accomplish the work. Replacement of Temporary Pavement Markings - Tape, as described above, will be incidental and no separate payment will be made.

Payment for the Temporary 6 Inch Black Pavement Marking Tape will be made at the Contract bid price per linear foot installed, which price shall include furnishing, installing, maintaining and removing the temporary tape and all materials, labor, equipment and incidentals necessary to accomplish the work. Replacement of 6 Inch Black Temporary Pavement Marking Tape, as described above, will be incidental and no separate payment will be made.

Payment will be made under:

Pay Item		Pay Unit
627.73	Temporary 6 Inch Pavement Marking Tape	Linear Foot
627.731	Temporary 6 Inch Black Pavement Marking Tape	Linear Foot

SPECIAL PROVISION

SECTION 634

HIGHWAY LIGHTING

(Remove and Reset Light Standard)

634.01 Description

The following paragraph is added:

This work shall consist of removing existing light standards, luminaires, and any breakaway devices and resetting at locations as shown on the Plans.

634.02 General

The following paragraphs are added:

All Contract work shall be overseen by a Maine licensed Master Electrician. The lead person for the field installations shall be either a Maine licensed Master Electrician, or a Maine licensed Journeyman Electrician. Apprentice Electricians, Helper Electricians, Journeyman-In-Training Electricians, and helpers may work under the Master or Journeyman Electrician as permitted under the law.

The Contractor shall comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical cable, wire and connectors; provide electrical cable, wire and connectors, which have been listed and labeled by Underwriters Laboratories, and comply with National Electrical Manufacturers Association/Insulated Power Cable Authorities Association Standards publications pertaining to materials, construction and testing wire cable, where applicable.

At a minimum the Contractor shall provide the following field quality control:

- Prior to energizing, check wire for continuity of circuitry and for short circuits with ohmmeter type testing equipment. Correct malfunction when detected.
- Subsequent to wire hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

634.051 Removing Light Standards

The first paragraph is deleted and replaced with the following:

Before removing light standards, the luminaires shall be removed from the light standard and stacked. The Contractor will not be allowed to remove the existing light standards until the temporary lighting has been installed.

634.052 Resetting Light Standards

Existing light standards shall be reset on to new foundations with a new or reset breakaway device.

634.092 Method of Measurement

The following sentence is added:

Removal and Resetting Light Standards will be measured by the single unit, complete in place and accepted.

634.093 Basis of Payment

The following paragraphs are added:

The accepted quantity of Remove and Reset Light Standards will be paid at the Contract unit price each for the number of units that are removed and reset. Payment shall be full compensation for the removal and resetting of the light standard, including luminaires, breakaway device reset or new breakaway device installed, new pole wires, new disconnect fuse kit, and all incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
634.208	Remove and Reset Light Standard	Each

SPECIAL PROVISIONS

SECTION 634

HIGHWAY LIGHTING

(Temporary Lighting)

634.01 Description

The following paragraph is added:

This work shall consist of maintenance of existing lighting, installing and removing temporary lighting, and relocating temporary lights in accordance with these Specifications and at locations for project phasing as shown on the Plans. The existing light standards, luminaries, and foundations may be utilized as temporary lights.

Kennebunk Service Plazas are 24 hour operations and therefore lighting shall be provided for the complete nighttime duration.

Temporary Lighting may not be powered by portable generators.

If necessary, disruption to existing ramp lighting is permitted during daylight hours in order to tie in to power source. Contractor shall verify voltage of all electrical circuits before any changes are made.

634.021 Materials

The following sentence is added:

Temporary roadway luminaries shall provide a minimum of 0.6 candle power in the parking areas.

The following Subsection is added:

634.053 Conductors

Conductors for temporary lighting shall be constructed utilizing techniques approved by the Resident. Shop drawings showing the proposed temporary lighting route and details shall be submitted by the Contractor for approval prior to the commencement of the work.

If approved, conductors may be hung from pole to pole in free air. Conductors hung from pole to pole shall have a sag that allows for a minimum vertical clearance from the conductor to the traveled way of no less than 20 feet.

634.092 Method of Measurement

The following sentence is added:

Temporary Lighting shall be measured for payment by the lump sum at each plaza.

634.093 Basis of Payment

The following sentences are added:

The accepted Temporary Lighting will be paid for at the contract lump sum price for each plaza. Lump sum payment shall be full compensation for furnishing, installing and erecting: ballasts, lamps, conduit, all wiring, breakaway devices when applicable, and all materials, labor, equipment and tools necessary to provide a fully operational temporary lighting system at each plaza.

Payment will be made under:

Pay Item		Pay Unit
634.22	Temporary Lighting (SB Plaza)	Lump Sum
634.23	Temporary Lighting (NB Plaza)	Lump Sum

SPECIAL PROVISION

SECTION 639

ENGINEERING FACILITIES

(Remove and Reset Field Office)

639.01 Description

The following paragraph is added:

This work shall consist of removing the field office supplied for the southbound plaza and transporting and resetting it at Kennebunk Maintenance during any winter shutdown and then removing, transporting and resetting it from Kennebunk Maintenance to the northbound service plaza. All other provisions of Section 639 shall apply.

639.10 Method of Measurement

Remove and Reset Field Office will be measured by the lump sum for removing, transporting and resetting the field office from the southbound service plaza to Kennebunk Maintenance and from Kennebunk Maintenance to the northbound service plaza.

639.11 Basis of Payment

Payment will be made under:

Pay Item		Pay Unit
639.191	Remove and Reset Field Office	Lump Sum

SPECIAL PROVISION

SECTION 645

HIGHWAY SIGNING

(Remove and Reset Sign)
(Remove and Stack Sign)

645.07 Demounting and Reinstalling Existing Signs and Poles

The following paragraphs are added:

At locations noted on the Plans, existing ground-mounted signs are designated to be removed and reset. This work shall consist of removing the sign panels, removing and resetting or disposing of the existing wood post and resetting the sign panels on a new wood post if required in the appropriate specified location. The Resident will determine if a new wood post is required.

Any existing signs not shown on the Plans are to remain in their existing condition unless directed otherwise by the Resident.

645.08 Method of Measurement

The following sentences are added:

Removing and Resetting existing ground-mounted signs shall be measured as complete units each, removed, reset and accepted.

645.09 Basis of Payment

The following paragraphs are added:

The accepted signs Removed and Reset will be paid for at the Contract unit price each as specified. Such price will include removing and resetting sign panels, removing and resetting or disposing existing wood post and resetting the sign panels on the existing or new wood post and new hardware as required to complete the sign installation. Any signs or supports damaged by the Contractor shall be replaced by him with new signs or supports conforming to the applicable Specifications at no additional cost to the Authority.

Payment will be made under:

Pay Item		Pay Unit
645.109	Remove and Reset Sign	Each

SPECIAL PROVISION

SECTION 652

MAINTENANCE OF TRAFFIC

(Specific Project Maintenance of Traffic Requirements)

This Specification describes the specific project maintenance of traffic requirements for this Project.

The following minimum traffic requirements shall be maintained:

Southbound Service Area Traffic Control Requirements

- Access to the gas and diesel dispensers for fuel service, temporary or permanent, shall be maintained at all times.
- Surface paving may occur during the day if completed before May 24, 2019.

Northbound Service Area Traffic Control Requirements

- Access to the gas islands and diesel dispensers for fuel service, temporary or permanent, shall be maintained at all times.

Some trench activities across pavement will be considered favorably for night work. The Contractor shall submit a request, in writing to the Resident. The approval will be at the Resident's discretion and will not be unreasonably withheld.

652.3.5 Installation of Traffic Control Devices

Portable Changeable message signs shall be installed on the mainline a minimum of two weeks prior to the temporary fueling systems being operational at either plaza.

SPECIAL PROVISION

SECTION 655

ELECTRICAL WORK

The following Section is added:

655.01 Description

This task shall include the providing and installation of the AWG wire, as described herein for clean and dirty power wiring, for grounding wires (where applicable) and other locations called for in the plans/specifications.

655.05 Measurement of Payment

Measurement and payment for furnishing and installation of the AWG wire as described herein will be per foot, to the nearest 10 foot interval per run.

Basis of Payment

The accepted quantity of AWG Wire will be paid for at the Contract unit price per linear foot for the furnishing, installation, routing, termination, splices and connection of the wire per plans and specifications.

Payment will be made under:

Pay Item		Pay Unit
655.101	#6 AWG Wire	Linear Foot
655.11	#10 AWG Wire	Linear Foot

SPECIAL PROVISION

SECTION 719

SIGNING MATERIAL

Section 719.01 Reflective Sheeting

This Subsection is deleted in its entirety and replaced with the following:

Retroreflective sheeting for signs shall meet at a minimum the requirements for, ASTM 4956 – Type VII, Type VIII or Type IX, for all signs. All Type 1 Guide Signs shall meet at a minimum the requirements for ASTM 4956 –Type XI sheeting. Use of overlay film that degrades the retroreflectivity of the sign sheeting (i.e. Avery-Dennison overlay film) will be prohibited.

Reflective sheeting, used in sign construction, shall have been manufactured within the six months immediately prior to the fabrication of each sign. Upon delivery at the job site of each shipment of signs, a letter of certification shall be provided that the reflective sheeting conforms to the requirements.

Signs may only be covered using materials and techniques explicitly approved by the sheeting manufacturer for that purpose and shall not alter the sign sheeting warranty.

- For Type 1 Guide Signs, all reflective sheeting shall be color matched on each sign unit.
- All warning signs shall be fluorescent yellow except for Ramp Advisory Speed signs which shall be yellow.
- All Construction Series signs that use orange backgrounds shall be fluorescent orange.
- All Pedestrian Signs shall be fluorescent yellow-green.
- EZ-PASS Purple shall conform to the FHWA Purple color block.

719.02 Demountable High Intensity Reflectorized Letters, Numerals, Symbols, and Borders

This Subsection, including the title, is deleted in its entirety and replaced with the following:

719.02 Direct Applied Reflectorized Letters, Numerals, Symbols, and Borders

Direct applied letters, numerals, symbols and borders shall consist of cut out sheeting shall meet at a minimum the requirements for ASTM 4956 – Type VII, Type VIII or Type IX sheeting.

All Type 1 Guide Signs shall meet at a minimum the requirements for ASTM 4956 –T y p e XI sheeting.

SPECIAL PROVISION

SECTION 800

BUILDING AND STRUCTURES

(Gasoline and Diesel Canopy Demolition)

800.31 Description

This work shall consist of all work necessary for the demolition of existing gasoline and diesel canopies at each plaza as shown on the Plans or described herein.

The following work in this item generally includes, but is not limited to the following:

1. The existing canopy, lighting, fire suppression, electrical, and all attached infrastructure shall be removed and disposed of in conformance with all local, State and Federal laws and regulations governing lead based paint and asbestos.
2. The existing canopy, lighting, fire suppression, electrical, and all attached infrastructure shall be removed and disposed after the existing fuel system has been taken out of service.

Items not included in this item are:

1. Removal of concrete islands, bumpers, and fuel slab will be paid under Item 202.17 Removing Existing Structural Concrete.
2. Removal of fuel dispenser and kiosks. These items will be removed by CN Brown and coordinated appropriately.

800.32 Coordination with CN Brown

The Contractor shall coordinate with CN Brown for the removal of the existing fuel dispensers and kiosks. The Contractor shall provide CN Brown with 10 days' notice prior to canopy removal and allow an additional 10 days to complete the removal of the fuel dispensers and kiosks.

800.32 Method of Measurement

The gasoline and diesel canopies demolition will be measured for payment as one lump sum per plaza, complete, and accepted.

800.34 Basis of Payment

The accepted quantity of canopy demolition will be paid for at the Contract lump sum price per plaza. All labor and materials required shall be incidental to this item.

Payment will be made under:

Pay Item		Pay Unit
800.20	Canopy Demolition – Gas and Diesel (SB Plaza)	Lump Sum
800.21	Canopy Demolition – Gas and Diesel (NB Plaza)	Lump Sum

SPECIAL PROVISION

SECTION 800

BUILDING AND STRUCTURES

(New Gasoline and Diesel Canopies)

800.51 Description

This work shall consist of furnishing and installing materials and components for two new gasoline and two new diesel canopies at the Northbound and Southbound Kennebunk Travel Plazas over the new dispenser slabs, as well as all other related electrical and communication facilities, fire suppression system, canopy lighting, and drainage facilities needed for the new canopies as detailed in the Plan drawings and these specifications.

800.52 Design Requirements

The proposed canopy system and foundations shall be designed and stamped by a Professional Engineer licensed in the State of Maine. The designs shall be completed in accordance with the latest edition of the International Build Code, MaineDOT Standard Specifications, applicable National Fire Protection Association codes, applicable National Electric Codes, and project-specific Special Provisions. The Contractor shall submit for MTA approval detailed plans and calculations for the proposed canopies, lighting, fire suppression, drainage, electrical, and associated foundations. The proposed canopies, lighting, fire suppression, and drainage shall be equal to the existing gasoline and diesel canopies at the Maine Turnpike West Gardiner Travel Plaza, or an approved equal.

800.53 Construction Requirements

The work in this item generally includes, but is not limited to: The contractor shall install new canopies over new gasoline and diesel dispenser slabs as shown in the plan drawings and described within these specifications. The canopy installation shall include shop painted structural steel, roofing system, drainage, fire suppression system, electrical mounted to or routed through the canopy, canopy lighting, all associated systems, as well as all material labor and equipment needed to provide the completed canopy. Contractor shall coordinate with the Resident Engineer and CN Brown, at least 30 days prior to canopy fascia assembly so CN Brown can provide the fascia decals.

800.54 Method of Measurement

The new canopies will be measured by lump sum for the design, detailing, fabrication, delivery, and construction of the gasoline and diesel canopies per plaza, including coordination with CN Brown, receipt of and factory installation of fascia signage.

800.55 Basis of Payment

The proposed canopy systems will be paid at the contract lump sum price per plaza for the pay items listed below. Such payment shall be full compensation for the design, detailing,

fabrication, delivery, and construction of the: new canopies, associated foundations, electrical and communication facilities, fire suppression system, canopy lighting, drainage facilities, and all other incidentals necessary to complete the work in accordance with the Plans and these specifications. All labor, materials and equipment required will be incidental to this item.

Drainage includes all canopy drainage items up to the first catch basin in the parking area.

Payment will be made under:

Pay Item		Pay Unit
800.50	New Canopy Installation – Gas and Diesel (SB Plaza)	Lump Sum
800.51	New Canopy Installation – Gas and Diesel (NB Plaza)	Lump Sum

SECTION 23 11 13

FACILITY FUEL PIPING

PART 1 - GENERAL

Contractor is responsible for full design of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Refer to Section 33 16 00 for Owner provided equipment. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fuel pipes, vents, and fittings.
2. Double-containment piping and fittings.
3. Piping specialties.
4. Joining materials.
5. Specialty valves.
6. Mechanical leak-detection valves.
7. Leak detection and monitoring system.
8. Labels and identification.

1.3 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include aboveground and underground locations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and dimensions of individual components and profiles.
2. Include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. For valves, include pressure rating, capacity, settings, and electrical connection data of selected models.

B. Shop Drawings: For fuel piping.

1. Include plans, elevations sections, and supports for pipes.
2. Include details of location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For fuel piping indicated to comply with performance requirements and design criteria.

1. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Detail fabrication and assembly of anchors and seismic restraints.
3. Design Calculations: Calculate requirements for selecting seismic restraints.
4. Detail fabrication and assembly of pipe anchors and supports for pipes, and attachments of the same to the fuel dispensers and tanks.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Plans and details, drawn to scale, on which fuel piping is shown and coordinated with other installations, using input from installers of the items involved.
2. Site Survey: Plans, drawn to scale, on which fuel piping and tanks are shown and coordinated with other services and utilities.

B. Welding certificates.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel equipment and accessories to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.

C. Store PE pipes and valves protected from direct sunlight.

1.9 FIELD CONDITIONS

A. Interruption of Existing Fuel Service: Do not interrupt fuel service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fuel supply according to requirements indicated:
   1. Contractor will be allowed up to a 24 hour period with a minimum 7-day notice given to MTA Resident Engineer and approval from the MTA on a mutually agreed upon date for the proposed interruption of fuel service.
   2. Do not proceed with interruption of fuel service without Owner's written permission.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of flexible, double-containment piping and related equipment that fail in materials or workmanship within specified warranty period.

   1. Failures due to defective materials or workmanship for materials including piping, dispenser sumps, water-tight sump entry boots, terminations, and other end fittings.

B. Verify available warranties and warranty periods for double-containment piping.
   1. Warranty Period for Below Ground Installation: 30 years from date of Substantial Completion.
   1. Warranty Period for Above Ground Installation: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Refer to Electrical Specifications.

B. Comply with ASME B31.9, "Building Services Piping," for Fuel piping materials, installation, testing, and inspecting.

C. Fuel Valves: Comply with UL 842 and have service mark initials "WOG" permanently marked on valve body. The water, oil, and gas (WOG) rating for the valve reflects the maximum pressure capability of the valve at 100 F.

D. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of Fuel piping.

2.2 FUEL PIPES, TUBES, AND FITTINGS

A. See materials below for pipes, vents, fittings, and joining materials are applied for fueling services:.

B. Aboveground Steel Pipe, vents, fittings and joining materials: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M, for butt and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel.
    e. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.

2.3 DOUBLE-CONTAINMENT PIPE AND FITTINGS

A. Flexible, Nonmetallic, Double-Containment Piping: Comply with UL 971 for underground fuel service.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. OPW Fueling Components; Dover Company.
    b. Franklin Fueling Systems.
    c. National Oilwell Varco.
    d. Substitutions will be considered by Owner.

2. Pipe Materials: PVDF complying with ASTM D 3222 for carrier pipe with mechanical couplings to seal carrier, and PE pipe complying with ASTM D 4976 for containment piping.
3. Fiberglass sumps.
4. Watertight sump entry boots, pipe adapters with test ports and tubes, coaxial fittings, and couplings.
5. Minimum Operating Pressure Rating: 10 psig.
6. Plastic to Steel Pipe Transition Fittings: Factory-fabricated fittings with plastic end matching or compatible with carrier piping, and steel pipe end complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
7. Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

2.4 PIPING SPECIALTIES

A. Nonmetallic Flexible Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. American Flexible Hose Co., Inc.
    b. Flexicraft Industries.
    c. FLEX-ING, Inc.
    d. Tru-Flex Metal Hose Corp.

e. Substitutions will be considered by Owner.

2. Listed and labeled for underground applications by an NRTL acceptable to authorities having jurisdiction.
3. PFTE bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
4. Minimum Operating Pressure: 150 psig.
5. End Connections: Socket, flanged, or threaded end to match connected piping.
6. Maximum Length: 30 inches.
7. Swivel end, 50-psig maximum operating pressure.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

2.5 JOINING MATERIALS

A. Joint Compound and Tape for Threaded Joints: Suitable for fuel.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

D. Bonding Adhesive for RTRP and RTRF: As recommended by piping and fitting manufacturer.

2.6 SPECIALTY VALVES

A. Pressure Relief Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Anderson Greenwood; Pentair, Ltd.
b. Fulflo Specialties, Inc.
c. OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.
d. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
e. Substitutions will be considered by Owner.

2. Listed and labeled for Fuel service by an NRTL acceptable to authorities having jurisdiction.
3. Body: Brass, bronze, or cast steel.
4. Springs: Stainless steel, interchangeable.
5. Seat and Seal: Nitrile rubber.
6. Orifice: Stainless steel, interchangeable.

7. Factory-Applied Finish: Baked enamel.
8. Maximum Inlet Pressure: 150 psig.
9. Relief Pressure Setting: 60 psig.

B. Fuel Safety Valves (Safety Breakaway Couplings and Non Return Valves):

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Anderson Greenwood; Pentair, Ltd.
    b. Fulflo Specialties, Inc.
    c. OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.
    d. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
    e. Substitutions will be considered by Owner.

2. Listed and labeled for Fuel service by an Nationally Recognized Testing Laboratories (NRTL) acceptable to authorities having jurisdiction.
3. Body: Brass, bronze, or cast steel.
4. Springs: Stainless steel.
5. Seat and Diaphragm: Nitrile rubber.
6. Orifice: Stainless steel, interchangeable.
7. Factory-Applied Finish: Baked enamel.
8. Manual override port.
9. Maximum Inlet Pressure: 60 psig.
10. Maximum Outlet Pressure: 3 psig.
11. Swing Joints – to relieve stress on suction line.

C. Emergency Shutoff Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. EMCO Wheaton.
    b. Franklin Fueling Systems.
    c. OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.
    d. Substitutions will be considered by Owner.

2. Listed and labeled for Fuel service by an Nationally Recognized Testing Laboratories (NRTL) acceptable to authorities having jurisdiction.
3. Single poppet valve.
4. Body: ASTM A 126, cast iron.
5. Disk: FPM.
6. Poppet Spring: Stainless steel.
7. Stem: Plated brass.
8. O-Ring: FPM.
9. Packing Nut: PTFE-coated brass.
10. Fusible link to close valve at 165 deg F.
11. Thermal relief to vent line pressure buildup due to fire.
12. Air test port.
13. Maximum Operating Pressure: 0.5 psig.

2.7 MECHANICAL LEAK-DETECTION VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Franklin Fueling Systems.
2. Red Jacket Pumps.
3. Substitutions will be considered by Owner.

B. Listed and labeled for Fuel service by an Nationally Recognized Testing Laboratories (NRTL) acceptable to authorities having jurisdiction.

C. Body: ASTM A 126, cast iron.

D. O-Rings: Elastomeric compatible with fuel.

E. Piston and Stem Seals: PTFE.

F. Stem and Spring: Stainless steel.

G. Piston Cylinder: Burnished brass.

H. Indicated Leak Rate: Maximum 3 gph at 10 psig.

I. Leak Indication: Reduced flow.

2.8 LEAK-DETECTION AND MONITORING SYSTEM

A. Cable and Sensor System: Comply with UL 1238.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Caldwell Systems Corporation.
b. Containment Solutions, Inc.
c. Franklin Fueling Systems.
d. Gems Sensors & ControlsInc.
e. Highland Tank & Manufacturing Company, Inc.
f. INCON, Inc.
g. In-Situ, Inc.
h. MSA Instrument Division.
i. Pentair Thermal Management.
j. Perma-Pipe, Inc.
k. Pneumercator Inc.
l. Veeder-Root Company (The).
m. Substitutions will be considered by Owner.

2. Calibrated leak-detection and monitoring system with probes and other sensors and remote alarm panel for Fuel piping.
3. Include fittings and devices required for testing.

2.9 LABELS AND IDENTIFICATION

A. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of Fuel piping.

B. Examine installation of fuel-burning equipment and fuel-handling and storage equipment to verify actual locations of piping connections before installing fuel piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off fuel to premises or piping section.

B. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Install underground fuel piping with a minimum of 3-feet of cover from top of pipe to grade:

B. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.
2. Replace pipe having damaged PE coating with new pipe.

C. Install double-containment, fuel pipe at a minimum slope of 0.5 percent downward toward Fuel storage tank sump.

D. Install vent pipe at a minimum slope of 2 percent downward toward Fuel storage tank sump.

E. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.

F. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.

G. Install fittings for changes in direction in rigid pipe.

H. Install system components with pressure rating equal to or greater than system operating pressure.

I. Vents: slope vent and suction pipes toward tanks (minimum 1.5%) making sure that there are no traps or lower places.

J. Swing Joints: use swing joint assembly for vent pipe over the tank and where vent rises out of the ground. Provide swing joint assembly for suction line above the tank and under pump. Swing joints relieve the piping from strains caused by the settling of the tank, frost heaving of the ground or pump island settling.

K. Provide extractable check valve on suction line above tank complete with 4-inch pipe and manhole.

L. Slope tank 3 inches away from suction end to avoid suction of water.

M. Ensure top of vent pipe is at least 12-feet above ground.

3.4 VALVE INSTALLATION

A. Install manual fuel shutoff valves on branch connections to Fuel appliance.

B. Install valves in accessible locations.

C. Install fuel safety valves at inlet of each dispenser.

D. Install pressure relief valves on discharge side of pumps and route relief back to tank.

E. Install one-piece, bronze ball valve with hose end connection at low points in Fuel piping.

F. Install manual air vents at high points in Fuel piping.

G. Install emergency shutoff valves at dispensers.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Bevel plain ends of steel pipe.
2. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tubing" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.

G. Flared Joints: Comply with SAE J513. Tighten finger tight then use wrench according to fitting manufacturer's written instructions. Do not overtighten.

H. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.6 LEAK-DETECTION AND MONITORING SYSTEM INSTALLATION

A. Install leak-detection and monitoring system. Install alarm panel inside building where indicated.

B. Double-Containment, Fuel Piping: Install leak-detection sensor probes at low points in piping and cable probes in interstitial space of double-containment piping.

3.7 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance.

B. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.

C. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.

D. Connect piping to equipment with shutoff valve and union. Install union between valve and equipment.

E. Install flexible piping connectors at final connection to burners or oil-fired appliances.

3.8 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each emergency service valve.

1. Text: In addition to identifying unit, distinguish between multiple units; inform operator of operational requirements; indicate safety and emergency precautions; and warn of hazards and improper operations.

B. Install detectable warning tape directly above Fuel piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs. Terminate tracer wire in an accessible area, and identify as "tracer wire" for future use with plastic-laminate sign.

1. Piping: Over underground Fuel distribution piping.

3.9 FIELD QUALITY CONTROL

A. Pressure Test Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:

1. Fuel Distribution Piping Pneumatic Test: Minimum 5 psig for minimum 30 minutes.
2. Fuel, Double-Containment Piping Hydrostatic Test:

    a. Carrier Pipe: Minimum 50 psig for minimum 30 minutes.
    b. Containment Conduit: Minimum 25 psig for minimum 60 minutes.

3. Suction Piping: Minimum 20-in. Hg for minimum 30 minutes.
4. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.

B. Inspect and test Fuel piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.

C. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Bleed air from Fuel piping using manual air vents.

F. Fuel piping and equipment will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 231113

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 4 - GENERAL

4.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

4.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Armored cable, Type AC, rated 600 V or less.
4. Photovoltaic cable, Type PV, rated 2000 V or less.
5. Mineral-insulated cable, Type MI, rated 600 V or less.
6. Tray cable, Type TC, rated 600 V or less.
7. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

4.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

B. VFC: Variable-frequency controller.

4.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

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

4.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency and/or manufacturer's authorized service representative.

B. Field quality-control reports.

4.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 5 - PRODUCTS

5.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with **ASTM B 8** for stranded conductors.

D. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.
2. Type RHW-2: Comply with UL 44.
3. Type SE: Comply with UL 854.
4. Type TC-ER: Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
5. Type UF: Comply with UL 83 and UL 493.
6. Type XHHW-2: Comply with UL 44.
7. Type MC-HL Comply with.

E. Shield:

1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

5.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors

E. Ground Conductor: Insulated.

F. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.
3. <Insert Type and standard>.

G. Armor: Steel interlocked.

H. Jacket: PVC applied over armor.

5.3 MINERAL-INSULATED CABLE, TYPE MI

A. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. UL 2196 for fire resistance.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper.

D. Insulation: Compressed magnesium oxide.

E. Sheath: Copper.

5.4 TRAY CABLE, TYPE TC

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in a nonmetallic jacket.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. RoHS compliant.
3. Comply with UL 1277.
4. Comply with ICEA S-73-532/NEMA WC 57 for Type TC cables used for control, thermocouple extension, and instrumentation.
5. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors Ground Conductor: Insulated.

D. Conductor Insulation: Type XHHW-2. Comply with UL 44.

E. Shield: Metallic.

5.5 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One or Two hole with standard barrels.
3. Termination: Compression.

PART 6 - EXECUTION

6.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

6.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance or Branch Circuits: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway, Type USE, single conductor in raceway, Mineral-insulated, metal-sheathed cable, Type MI, or Multiconductor cable, Type SE.

B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

C. VFC Output Circuits: Type XHHW-2 in metal conduit, Type TC-ER cable with braided shield, or Type TC-ER cable with dual tape shield.

6.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

6.4 CONNECTIONS

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

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 612 inches (300 mm) of slack.

6.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

6.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

6.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

6.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors

3. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports to record the following:

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

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 7 - GENERAL

7.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

7.2 SUMMARY

A. Section Includes:

1. Backboards.
2. Category 6a balanced twisted pair cable.
3. Balanced twisted pair cabling hardware.
4. RS-485 cabling.
5. Low-voltage control cabling.
6. Control-circuit conductors.
7. Identification products.

7.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

D. RCDD: Registered Communications Distribution Designer.

7.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

7.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency, RCDD, layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

7.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 8 - PRODUCTS

8.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

E. RoHS compliant.

8.2 BACKBOARDS

A. Description: Plywood 3/4 by 48 by 48 inches.

B. Painting: Paint plywood on all sides and edges with flat White latex paint.

8.3 CATEGORY 6a BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.

B. Standard: Comply with TIA-568-C.2 for Category 6a cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP), Shielded twisted pairs (FTP), Screened twisted pairs (F/UTP), or Screened and shielded twisted pairs (F/FTP).

E. Cable Rating: Riser.

F. Jacket: Blue thermoplastic.

8.4 BALANCED TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

B. General Requirements for Balanced Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain balanced twisted pair cable hardware from same manufacturer as balanced twisted pair cable, from single source.

D. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

F. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
3. Number of Jacks per Field: One for each four-pair required.

G. Patch Cords: Factory-made, four-pair cables in 36-inch (900-mm) lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

H. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
3. Marked to indicate transmission performance.

I. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standards:

    a. Category 5e, unshielded balanced twisted pair cable shall comply with IEC 60603-7-2.
    b. Category 5e, shielded balanced twisted pair cable shall comply with IEC 60603-7-3.
    c. Category 6, unshielded balanced twisted pair cable shall comply with IEC 60603-7-4.
    d. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
    e. Category 6a, unshielded balanced twisted pair cable shall comply with IEC 60603-7-41.
    f. Category 6a, shielded balanced twisted pair cable shall comply with IEC 60603-7.51.

4. Marked to indicate transmission performance.

J. Faceplate:

1. Two port, vertical single-gang faceplates designed to mount to single-gang wall boxes.
2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of balanced twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

K. Legend:

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

8.5 TWIN-AXIAL DATA HIGHWAY CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, as required pairs, No. 20 AWG, stranded 7x28 tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.

4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, <Insert number> pairs, No. 20 AWG, stranded (7x28) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

8.6 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262.

8.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

8.8 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper Type TC, complying with UL 1277 in raceway or Type MC, complying with UL 1569.

B. Class 2 Control Circuits: Stranded copper, power-limited tray cable, in cable tray.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, power-limited tray cable, in cable tray or Type TW or Type TF, complying with UL 83, in raceway.

D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

8.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 9 - EXECUTION

9.1 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

9.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits [3 inches (75 mm)] <Insert dimension> above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

9.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware (Communications Copper Horizontal Cabling) unless otherwise indicated.

3. Do not untwist balanced twisted pair cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

9.4 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

9.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

9.6 FIRESTOPPING

A. Provide Firestopping in Penetrations.

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

9.7 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

9.8 IDENTIFICATION

A. Provide Identification for Electrical Systems.

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

9.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.

D. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

E. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

F. End-to-end cabling will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 10 - GENERAL

10.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

10.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and

10.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

D. PGRS: PVC coated galvanized rigid steel conduit

10.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Sustainable Design Submittals:

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

10.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

C. Source quality-control reports.

PART 11 - PRODUCTS

11.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

a. Comply with NEMA RN 1.
b. Coating Thickness: 0.040 inch (1 mm), minimum.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:
1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Fittings for EMT:

    a. Material: Steel.
    b. Type: compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

11.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:
1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:

    a. Comply with NEMA TC 14.
    b. Comply with UL 2515 for aboveground raceways.
    c. Comply with UL 2420 for belowground raceways.

3. RNC: [Type EPC-40-PVC] <Insert type>, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
4. LFNC: Comply with UL 1660.
5. Rigid HDPE: Comply with UL 651A.
6. Continuous HDPE: Comply with UL 651A.
7. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
8. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

    a. Fittings for LFNC: Comply with UL 514B.

3. Solvents and Adhesives: As recommended by conduit manufacturer.

11.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 4 or Type 12 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type or Flanged-and-gasketed type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

11.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

11.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep

M. Gangable boxes are allowed

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4X or Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic or Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

11.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC" or “COMMUNICAITION” per respective system.

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.
1. Standard: Comply with SCTE 77.
2. Color of Frame and Cover: Gray.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, , "ELECTRIC" or “COMMUNICAITION” per respective system.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

11.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 12 - EXECUTION

12.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC or LFNC based on connecting conduit.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC

4. Concealed in Ceilings and Interior Walls and Partitions: EMT

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1-inch (26-mm)] trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

12.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 3 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to GRC before rising above floor.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

X. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet .
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semirecessed luminaires,]equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Z. Mount boxes at heights as required. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

12.3 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

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

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

12.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install 0sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

12.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

12.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer. END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 13 - GENERAL

13.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

13.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Flexible nonmetallic duct.
4. Duct accessories.
5. Precast concrete handholes.
6. Polymer concrete handholes and boxes with polymer concrete cover.
7. Fiberglass handholes and boxes with polymer concrete cover.
8. Fiberglass handholes and boxes.
9. High-density plastic boxes.
10. Precast manholes.
11. Cast-in-place manholes.
12. Utility structure accessories.

13.3 DEFINITIONS

A. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

B. GRC: Galvanized rigid (steel) conduit.

C. Traffic ways: Locations where vehicular or pedestrian traffic is a normal course of events.

13.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.
2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Include accessories for manholes, handholes, boxes, and other utility structures.
4. Include underground-line warning tape.
5. Include warning planks.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole chimneys.
e. Include ladder details.
f. Include grounding details.
g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
h. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

C. Sustainable Design Submittals:

13.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

C. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

D. Source quality-control reports.

E. Field quality-control reports.

13.6 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

13.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

13.8 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two (2) days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 14 - PRODUCTS

14.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

B. Coated Steel Conduit: PVC-coated GRC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

14.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

C. Solvents and Adhesives: As recommended by conduit manufacturer.

14.3 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

C. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.

1. Color: Red dye added to concrete during batching.
2. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

14.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

1. Cover Hinges: Concealed, with hold-open ratchet assembly.
2. Cover Handle: Recessed.

D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

E. Cover Legend: Molded lettering, "ELECTRIC." Or “COMMUNICATION” as indicated for each service.

F. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

G. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

1. Extension shall provide increased depth of 12 inches.
2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

H. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

I. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
3. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
4. Knockout panels shall be 1-1/2 to 2 inches thick.

J. Handholes shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

14.5 FIBERGLASS HANDHOLES AND BOXES WITH POLYMER CONCRETE FRAME AND COVER

A. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

C. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, "ELECTRIC." Or “COMMUNICATION” as indicated for each service.

G. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

I. Handholes shall have factory-installed inserts for cable racks and pulling-in irons.

14.6 PRECAST MANHOLES

A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

B. Comply with ASTM C 858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

D. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
3. Knockout panel shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
4. Knockout panels shall be 1-1/2 to 2 inches thick.

E. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct to be terminated.
2. Fittings shall align with elevations of approaching duct and be located near interior corners of manholes to facilitate racking of cable.

F. Ground Rod Sleeve: Provide a 3-inch (75-mm) PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.

G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

14.7 CAST-IN-PLACE MANHOLES

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for duct entrance and sleeve for ground rod.

B. Materials: Comply with ASTM C 858 regarding Cast-in-Place Concrete.

C. Structural Design Loading: As specified in "Underground Enclosure Application" Article.

14.8 UTILITY STRUCTURE ACCESSORIES

A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.

B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof with milled cover-to-frame bearing surfaces; diameter, 29 inches.

    a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

    a. Legend: "ELECTRIC-LV" for duct systems with power wires for systems operating at 600 V and less.

b. Legend: "COMMUNICATION" for duct systems with communication cables.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
   a. Seal joints watertight using preformed plastic or rubber complying with ASTM C 990. Install sealing material according to sealant manufacturers' written instructions.

C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch (150-mm), 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.

F. Pulling-in and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

H. Ground Rod Sleeve: 3-inch (75-mm) PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

J. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
   1. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Fixed Manhole Ladders: Arranged for attachment to roof or wall of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.

14.9 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

PART 15 - EXECUTION

15.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain. Remove and stockpile topsoil for reapplication.

15.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.

B. Stub-ups: Concrete-encased PVC-coated GRC.

15.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
   4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
   5. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: Precast or cast-in-place concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

15.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures.

15.5 DUCT AND DUCT-BANK INSTALLATION

A. As required for the project, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.

2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

K. Pulling Cord: Install 200-lbf- test nylon cord in empty ducts.

L. Concrete-Encased Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
2. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
3. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
4. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
5. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
6. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

1) Stub-ups shall be 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.

c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.

1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.

7. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
9. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 3 inches between duct of like services, and 12 inches between power and communications ducts.
10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.

11. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

M. Underground-Line Warning Tape: Bury underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

15.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and traffic ways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Install handholes with bottom below frost line.
4. Handhole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes as required. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Damp proofing: Apply damp proofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Damp proofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

H. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

I. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

15.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and traffic ways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame.

1. Concrete: 3000 psi, 28-day strength, with a troweled finish.

15.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

15.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

15.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.

1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION 260543

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

2.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

2.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 3 - PRODUCTS

3.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

3.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an red field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase-[and Voltage-Level] Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 240-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.

4. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

5. Color for Neutral: White (208/120V System) or Gray (480/277V systems).
6. Color for Equipment Grounds: Green.
7. Colors for Isolated Grounds: Green with white stripe.

C. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on an red background.
2. <Insert colors>.

E. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

F. Equipment Identification Labels:

1. Black letters on a white field.

3.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

D. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

3.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F . Comply with UL 224.

3.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop vms

D. es at legends.

E. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

F. Underground-Line Warning Tape:
   1. Tape:
      a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
      b. Printing on tape shall be permanent and shall not be damaged by burial operations.
      c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
   2. Color and Printing:
      a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
      b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
      c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE"

G. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

3.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

3.7 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:
1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. in, minimum 1/16 inch thick.
b. For signs larger than 20 sq. in, 1/8 inch thick.
c. Engraved legend with black letters on white face.
d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

3.8 CABLE TIES

A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

B. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

3.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 4 - EXECUTION

4.1 PREPARATION

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

4.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."
4. “COMMUNICATION”

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

V. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope, exceeds 16 inches overall.

W. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

X. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

Y. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

Z. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

AA. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

4.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- high, black letters on 20-inch centers.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot maximum intervals.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "COMMUNICATION."

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels, self-adhesive wraparound labels, or snap-around labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes or self-adhesive labels with the conductor designation.

I. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

J. Auxiliary Electrical Systems Conductor Identification: Marker tape or Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

K. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

L. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

M. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

N. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

O. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels, Baked-enamel warning signs, or Metal-backed, butyrate warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.

b. Controls with external control power connections.

P. Arc Flash Warning Labeling: Self-adhesive labels.

Q. Operating Instruction Signs: Self-adhesive labels, Baked-enamel warning signs, Metal-backed, butyrate warning signs, or Laminated acrylic or melamine plastic signs.

R. Emergency Operating Instruction Signs: Self-adhesive labels, Baked-enamel warning signs, Metal-backed, butyrate warning signs, Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions.

S. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label, Baked-enamel signs, Metal-backed butyrate signs, Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power-transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION 260553

SECTION 260572 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 16 - GENERAL

16.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

16.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

16.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

16.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form and printed form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of

sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

16.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist, and Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

16.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 17 - PRODUCTS

17.1 COMPUTER SOFTWARE

A. Comply with IEEE 399 and IEEE 551.

B. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

17.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 18 - EXECUTION

18.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For relocated equipment and that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

18.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Control panels.
7. Standby generators and automatic transfer switches.
8. Branch circuit panelboards.
9. Disconnect switches.

18.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

18.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260572

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 19 - GENERAL

19.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

19.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

19.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

19.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form and printed form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

19.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Specialist, and Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

19.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. Include Operation and Maintenance Data, and the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

19.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing

laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 20 - PRODUCTS

20.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

    a. Arcing faults.
    b. Simultaneous faults.
    c. Explicit negative sequence.
    d. Mutual coupling in zero sequence.

20.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

    a. Phase and Ground Relays:

        1) Device tag.
        2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
        3) Recommendations on improved relaying systems, if applicable.

    b. Circuit Breakers:

        1) Adjustable pickups and time delays (long time, short time, ground).
        2) Adjustable time-current characteristic.
        3) Adjustable instantaneous pickup.
        4) Recommendations on improved trip systems, if applicable.

    c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.

6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 21 - EXECUTION

21.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

21.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

G. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

L. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

21.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

21.4 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

21.5 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.

15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

21.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

21.7 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573

SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 22 - GENERAL

22.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

22.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

22.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

22.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form and printed form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of

sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

22.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist, Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

22.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

22.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 23 - PRODUCTS

23.1 COMPUTER SOFTWARE DEVELOPERS

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

23.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

23.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 24 - EXECUTION

24.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

24.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:
1. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

24.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
1. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
2. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.

10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

24.4 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Control panel.

24.5 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

24.6 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 260574

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 25 - GENERAL

25.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

25.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Digital timer light switches.
7. High-bay occupancy sensors.
8. Extreme temperature occupancy sensors.
9. Outdoor motion sensors.
10. Lighting contactors.
11. Emergency shunt relays.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

25.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

25.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment will be attached.
3. Items penetrating finished ceiling, including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Control modules.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranties.

25.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

25.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 26 - PRODUCTS

26.1 TIME SWITCHES

A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program[on selected channels].
6. Automatic daylight savings time changeover.
7. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

B. Electromechanical-Dial Time Switches: Comply with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 24 hours.

26.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Description: Solid state, with SPST dry contacts rated for 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
6. Failure Mode: Luminaire stays ON.
7. Power Pack: Dry contacts rated for 20-A ballast, or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

a. LED status lights to indicate load status.
b. Plenum rated.

26.3 INDOOR OCCUPANCY AND VACANCY SENSORS

A. General Requirements for Sensors:

1. Wall or Ceiling-mounted, solid-state indoor occupancy sensors.
2. Passive infrared and Ultrasonic technology.
3. Integrated or Separate power pack.
4. Hardwired connection to switch, BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:
   a. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
8. Power: Line voltage.
9. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. PIR Type: Wall or Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

C. Ultrasonic Type: Wall or Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

D. area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted48 inches above finished floor.

26.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS,.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.

26.5 DIGITAL TIMER LIGHT SWITCH

A. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 10 minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for ballast or LED, and 1/4 horsepower at 120-V ac.
2. Integral relay for connection to BAS.
3. Voltage: Dual voltage - 120 and 277 V.
4. Faceplate: Color matched to switch.

26.6 EXTREME-TEMPERATURE OCCUPANCY SENSORS

A. Description: Ceiling-mounted, solid-state, extreme-temperature occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application in damp locations.
2. Operation: Turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
3. Operating Ambient Conditions: From minus 40 to plus 125 deg F.

4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
5. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
6. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind cover.

7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 10 fc; keep lighting off when selected lighting level is present.

B. Detector Technology: PIR. Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1500 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage High Bay: Detect occupancy within 25 feet when mounted on a 25-foot- high ceiling.

26.7 OUTDOOR MOTION SENSORS

A. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Dual-technology (PIR and infrared) type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.. Comply with UL 773A.
3. Switch Rating:

    a. Luminaire-Mounted Sensor: 1000-W incandescent, 500-VA fluorescent/LED.
    b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.

4. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off." With bypass switch to override the "on" function in case of sensor failure.
5. Voltage: Dual voltage, 120- and 277-V type.
6. Detector Coverage:

    a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

26.8 LIGHTING CONTACTORS

A. Description: Electrically operated and mechanically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.

26.9 EMERGENCY SHUNT RELAY

A. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 277 V.

26.10 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 27 - EXECUTION

27.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

27.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

27.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

27.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

27.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

27.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

27.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

27.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

27.9 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

PART 28 - GENERAL

28.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Owner provided equipment is listed in Section 1.1 below and is to be delivered to the site. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

28.2 SUMMARY

A. Section Includes:

1. Straight-blade convenience, hospital-grade, isolated-ground, and tamper-resistant receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. SPD receptacles.
5. Hazardous (classified) location receptacles.
6. Twist-locking receptacles.
7. Pendant cord-connector devices.
8. Cord and plug sets.
9. Toggle switches.
10. Decorator-style convenience.
11. Wall switch sensor light switches with dual technology sensors.
12. Wall switch sensor light switches with passive infrared sensors.
13. Wall switch sensor light switches with ultrasonic sensors.
14. Digital timer light switches.
15. Residential devices.
16. Wall-box dimmers.
17. Wall plates.
18. Floor service outlets.
19. Poke-through assemblies.
20. Prefabricated multioutlet assemblies.
21. Service poles.

28.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.

4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

28.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

28.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

28.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

28.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no fewer than one.
2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one numbe.
3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
4. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 29 - PRODUCTS

29.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

D. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

29.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Tamper-Resistant Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Double click here to find, evaluate, and insert list of manufacturers and products.
2. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

29.3 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, feed, non-feed, through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Tamper-Resistant, Duplex GFCI Convenience Receptacles:

29.4 SPD RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.

1. 125 V, 20 A, straight-blade type.
2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex SPD Convenience Receptacles:

29.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Hazardous (Classified) Locations Receptacles: Comply with NEMA FB 11 and UL 1010.

29.6 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

29.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

29.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

29.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole:

2. Two Pole:

3. Three Way:

4. Four Way:

C. Pilot-Light Switches: 120/277 V, 20 A.
1. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

D. Key-Operated Switches: 120/277 V, 20 A.
1. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

29.10 WALL SWITCH SENSOR LIGHT SWITCH, DUAL TECHNOLOGY

A. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual technology.

1. Connections: Provisions for connection to BAS.
2. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
3. Integral relay for connection to BAS.
4. Adjustable time delay.
5. Able to be locked to Manual-On mode.
6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
7. Comply with NEMA WD 1, UL 20, and FS W-S-896.

29.11 DIGITAL TIMER LIGHT SWITCH

A. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in [10] [20]-minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
2. Integral relay for connection to BAS.

29.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

29.13 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for twisted pair cable complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

29.14 POKE-THROUGH ASSEMBLIES

A. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."
4. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

29.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: 18 inches (460 mm).
3. Wiring: No. 12 AWG solid, Type THWN copper, single circuit.

29.16 SERVICE POLES

A. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Nominal 2.5-inch- square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Satin-anodized aluminum.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.
6. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
7. Data Communication Outlets: Four RJ-45 jacks complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

29.17 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. SPD Devices: Blue.

B. Wall Plate Color: For plastic covers, match device color.

PART 30 - EXECUTION

30.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

30.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

30.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with blackfilled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

30.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

F. Wiring device will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 31 - GENERAL

31.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

31.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

31.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

31.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

31.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

31.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. Submit Operation and Maintenance Data, in addition to the following:

a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and electronic format.

31.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

31.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

31.9 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F

2. Altitude: Not exceeding 6600 feet.

31.10 WARRANTY

A. that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 32 - PRODUCTS

32.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

32.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

32.3 FUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. 600-V ac.
3. 200 A and smaller.
4. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
5. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.

4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 240-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

32.4 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switchblades open. Contact rating - 240-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

32.5 RECEPTACLE SWITCHES

A. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac, 60A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

B. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 600-V ac, 60A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 240-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

32.6 SHUNT TRIP SWITCHES

A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac, 60 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 600-V ac, 60 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, pilot, indicating and control devices.

E. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight red ON pilot light.
3. Isolated neutral lug; 200 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
8. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
9. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
10. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
11. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 240-V ac.
12. Hookstick Handle: Allows use of a hookstick to operate the handle.
13. Lugs: Mechanical type, suitable for number, size, and conductor material.
14. Service-Rated Switches: Labeled for use as service equipment.

32.7 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

C. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated series rated Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

D. MCCBs shall be equipped with a device for locking in the isolated position.

E. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

K. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

L. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

M. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

N. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: One SPDT switchwith "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
8. Electrical Operator: Provide remote control for on, off, and reset operations.
9. Accessory Control Power Voltage: Integrally mounted, self-powered.

32.8 MOLDED-CASE SWITCHES

A. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

B. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

C. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs:

    a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
    b. Lugs shall be suitable for 194 deg F (90 deg C) rated wire, sized according to the 167 deg F temperature rating in NFPA 70.

3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
6. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
7. Electrical Operator: Provide remote control for on, off, and reset operations.
8. Accessory Control Power Voltage: Integrally mounted, self-powered.

32.9 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel) or copper-free cast aluminum alloy (NEMA 250 Types 7, 9).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both end walls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 33 - EXECUTION

33.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

33.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager and Owner] no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.
4. Comply with NFPA 70E.

33.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 12.

2. Outdoor Locations: NEMA 250, Type 4X.
3. Wash-Down Areas: NEMA 250, Type 4X.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4..
5. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

33.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

33.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

33.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

E. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.

g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

33.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges coordination study

END OF SECTION 262816

SECTION 265613 - LIGHTING POLES AND STANDARDS

PART 34 - GENERAL

34.1 RELATED DOCUMENTS

A. Contractor is responsible for full design (All Disciplines) of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems at the Kennebunk Southbound and Northbound service station sites.

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

34.2 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.
2. Luminaire-lowering devices.

34.3 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

34.4 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Include finishes for lighting poles and luminaire-supporting devices.
3. Anchor bolts.

B. Sustainable Design Submittals:

C. Shop Drawings:

1. Include plans, elevations, sections, mounting, attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly of poles and pole accessories.
4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

34.5 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Qualification Data: For Installer.

C. Material Test Reports:

1. For each foundation component, by a qualified testing agency.
2. For each pole, by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: Manufacturer's standard warranty.

G. Soil test reports

34.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For poles and luminaire-lowering devices to include in emergency, operation, and maintenance manuals.

1. Submit Operation and Maintenance Data, and include pole inspection and repair procedures.

34.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

34.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

34.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below finished grade.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

34.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) and luminaire-lowering device(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: Five years from date of Substantial Completion.
2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 35 - PRODUCTS

35.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pole foundation and pole power system.

B. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified
2. Component Importance Factor: 1.0.

C. Structural Characteristics: Comply with AASHTO LTS-6-M.

D. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.

E. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.

F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

1. Basic wind speed for calculating wind load for poles exceeding 50 feet (15 m) in height is 100 mph (45 m/s).

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 50 years.
c. Velocity Conversion Factor: 1.0

G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

35.2 STEEL POLES

A. Source Limitations: Obtain poles from single manufacturer or producer.

B. Source Limitations: For poles, obtain each color, grade, finish, type, and variety of pole from single source with resources to provide products of consistent quality in appearance and physical properties.

C. Poles: Comply with ASTM A 240/A 240M, stainless steel with a minimum yield of 55,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Matching existing.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

D. Steel Mast Arms: continuously welded to pole attachment plate. Material and finish same as plate.

E. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with [stainless] [galvanized]-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

F. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

G. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

H. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

I. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

J. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.

K. Platform for Lamp and Ballast Servicing: Factory fabricated of steel, with finish matching that of pole.

L. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

M. Galvanized Finish: After fabrication, hot-dip galvanize according to ASTM A 123/A 123M.

N. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's full range.

O. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces according to SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder Coat: Comply with AAMA 2604.

    a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5- to 3.5-mils dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: As selected by Architect from manufacturer's full range.

35.3 ALUMINUM POLES

A. Poles: extruded structural tube complying with ASTM B 221, Alloy 6061-T6, with access handhole in in pole wall.

1. Shape: Matching Existing.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Mast Arms: continuously welded to pole attachment plate. Material and finish same as plate.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's full range.

K. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder coat shall comply with AAMA 2604.

    a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: As selected by Architect from manufacturer's full range.

35.4 POLE ACCESSORIES

A. Duplex Receptacle: Ground-fault circuit interrupter type, 120 V ac, 20 A in a weatherproof assembly. Comply with requirements in Section 262726 "Wiring Devices."

1. Recessed 12 inches (300 mm) above finished grade.

    a. NEMA 250, Type 4X, nonmetallic polycarbonate plastic or reinforced fiberglass, enclosure with cover; color to match pole.
    b. Lockable hasp and latch complying with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

D. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept ballast(s) and accessories. Include removable flanged access cover secured with bolts or screws.

35.5 LOWERING SYSTEM FOR LUMINAIRES

A. System Description: Capable of lowering luminaire to a service position within 36 inches of finished grade in winds up to 30 mph. Provide manual plug connection to electrical power accessible in lowered position. Assembled system of pole, luminaire, and lowering device shall be capable of loads specified in "Performance Requirements" Article.

B. Compatibility of Material: Materials for attachment and connection of luminaire-mounting assembly, lowering device, lowering cable, and portable winch shall be compatible to avoid corrosion and electrolysis.

C. Structural and Mechanical Design Safety Factor: 5.0, minimum, for static and dynamic loads of load-bearing components, including cable.

D. Luminaire-Mounting and Disconnect Arrangement: Multiple carriage-mounted luminaires, arranged for lowering and rising as a group.

1. Electrical cable for normal operating power to luminaires shall manually disconnect inside pole base, using weatherproof multi-pin connector, and shall be arranged to move within the pole during lowering and rising of luminaire assembly.

2. Electrical cable for normal operating power to luminaires shall automatically disconnect at weatherproof multi-pin connector within the pole-top lowering head at the beginning of the lowering cycle and reconnect when luminaire or luminaire assembly is raised to the operating position.

E. Lowering Device: Weatherproof, cast-aluminum housing, and multiple mechanical latches. Moving parts of latching assembly shall be located in the portion of the unit that is lowered to servicing position. Positive latching in the operating position shall be indicated to the operator at the base of the pole by a clear visual signal or by other means acceptable to Owner or authorities having jurisdiction.

F. Lowering Cable: stainless steel aircraft cable.

Coordinate "Portable Winch" Paragraph below with Drawings.

G. Portable Winch: 120-V electric type. One required.

1. Winch Power Connection: Cord and plug.
2. Winch Raise-Lower Control: Remote-control station with 15 feet (5 m) of cable.

35.6 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi (380,000 kPa).

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Headed rods as required in diameter by as required in length.
3. Threading: Uniform National Coarse, Class 2A.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Four nuts provided per anchor bolt.

C. Washers: ASTM F 436, Type 1.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Two washers provided per anchor bolt.

35.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 36 - EXECUTION

36.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

36.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

D. Direct-Buried Foundations: As required, but not less than one-sixth of pole height. Add backfill in 6-inch to 9-inch layers, tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

E. Direct-Buried Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

1. Make holes 6 inches in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

F. Anchor Bolts: Install plumb using manufacturer-supplied steel template, uniformly spaced.

36.3 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: 60 inches.
2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet.
3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2 -inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

36.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

36.5 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundation.

36.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

36.7 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

END OF SECTION 265613

SECTION 33 16 00
FUEL STORAGE AND DISPENSING EQUIPMENT

PART 1 - GENERAL

Contractor is responsible for full design of the entire fuel storage and dispensing systems. Designs shall be stamped and signed by licensed Professional Engineers in the State of Maine. Owner-Furnished Equipment is listed in Section 1.1 below and is to be delivered to the site. Contractor is responsible for all installation, testing and commissioning work for complete and operational aboveground and underground storage and dispensing fuel systems.

1.1 SECTION INCLUDES

A. Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel System) – Southbound Plaza (SB) is Owner-Furnished Equipment and installed by Contractor and both Relocated and installed at Northbound Plaza by Contractor.

B. Underground Fuel Tanks, Sumps and Sump Covers – Owner-Furnished Equipment for both SB & NB and installed by Contractor.

C. Fuel Dispensers for Underground Tanks – Existing NB & SB fuel dispensers for Underground Tanks will be removed by CN Brown. The new NB & SB fuel dispensers for Underground Tanks will be provided by CN Brown and installed by Contractor.

D. Submersible Fuel Pumps – NB & SB by Contractor.

E. Underground Fuel Tank Alarms, Sensors and Probes - NB & SB by Contractor.

F. Fuel Management System - NB & SB by Contractor.

1.2 RELATED SECTIONS

A. 23 11 13 – Facility Fuel-Piping

1.3 SUBMITTALS

A. Contractor shall develop design details for the complete new fuel systems, including but not limited to mechanical, electrical, and civil components, and make a minimum of two submittals for review, comment and approval before proceeding; approximately at 90% and at 100% development. Construction shall not begin until approval is received from Maine Turnpike Authority.

B. Shop drawings: Contractor shall submit the following for review and approval prior to approval:

1. Shop drawings of all fuel delivery equipment complete with all accessories supplied by the manufacturer.

2. Detailed shipping, handling and installation instructions.

1.4 QUALITY ASSURANCE

A. Equipment installations in the United States:

1. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with equipment manufacturer's Installation and Operating Guidelines recommendations for delivery, storage, and tank handling.

1.6 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranties.

PART 2 - PRODUCTS

A. Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel System): Contractor to review Owner-Furnished Equipment, assess any missing components, include missing items in the final design for review by Owner and provide those items to complete the installation of this system. See attached Owner-Furnished Equipment drawings.

B. Underground Fuel Tanks: Contractor to review Owner-Furnished Equipment, assess any missing components, include missing items in the final design for review by Owner and provide those items to complete the installation of this system. See attached Owner-Furnished Equipment drawings.
   1. Underground tanks, sumps, and sump lids shall be the same as provided for Southbound Plaza unless approved otherwise in writing by the MTA.
   2. Tank Design - Fiberglass reinforced plastic (FRP) tanks. Double wall vessel. Refer to Owner Provided SB UST drawings.
   3. Tanks shall be 10 feet in diameter.
   4. Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.
   5. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
   6. Tank shall be vented to atmospheric pressure.
   7. Tank shall be capable of handling liquids with specific gravity up to 1.1.
   8. Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.
   9. Loading Conditions - Tank shall meet the following design criteria:
      a. Internal Load - Tank shall be designed to withstand a 5-psig (35 kPa) air-pressure test with a 5:1 safety factor.
      b. Surface Loads - Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
      c. External Hydrostatic Pressure for Underground Water Tank - Tank shall be designed for 7 feet of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.
   10. Interstitial Space:
      a. The interstitial space between the primary and secondary walls shall be constructed with a glass reinforcement material such as Parabeam, which provides a structural bond between the two tank walls, while creating a defined interstice that allows for free flow of liquid.
      b. The interstitial space shall be factory brine filled.
      c. A tank top fitting shall be provided to allow for a monitoring sensor to be installed at the bottom of the interstice.
      d. The interstice of the tank shall be designed to withstand 20-psig (138 kPa) pressure.
   11. Fuel Storage Applications:
      a. Governing Standards, as applicable:
      b. American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.
      c. NFPA 30: Flammable and Combustible Liquids Code.
      d. NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages.
      e. NFPA 31: Standard for the Installation of Oil-Burning Equipment.

f. Underwriters Laboratories (UL) Standard for Safety 1316 Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures.

C. Underground Fuel Tank Sumps and Sump Covers: Contractor to review Owner-Furnished Equipment, assess any missing components, include missing items in the final design for review by Owner and provide those items to complete the installation of this system. See attached Owner-Furnished Equipment drawings.

1. Sump and Sump Cover Design – 100% Fiberglass reinforced plastic (FRP) construction:
2. Sump and Sump Cover Design: Large rigid base with tank collar mount attachment. Refer to Owner Provided SB UST drawings. Include bright white color interior for improved visibility. Coat interior with manufacturer's recommended resin gel coating to act as a barrier for any contained fuel. Include 32" – 72" adjustable height riser. Provide water-tight access cover. No metal parts allowed.
3. Refer to Owner Provided SB UST drawings for the sump and sump cover size, fittings and accessories.

D. Fuel Dispensers for Motor Gasoline and Auto Diesel for Underground Tanks: Contractor to review CN Brown-Furnished Equipment, assess any missing components, include missing items in the final design for review by Owner and provide those items to complete the installation of this system.

1. Single Product, Single Nozzle, Standard Duty Fuel Dispensers (10.5 gpm).
2. Two Product, Dual Nozzle, Standard Duty Fuel Dispensers (10.5 gpm).
3. Accuracy/Maximum permissible error ± 0.25%.
4. Power Supply 230V ± 6% Single phase, 50 Hz ± 1%.
5. Location Outdoor, hazardous/classified area.
6. Noise Level Shall not exceed 75 dB at 3.3 feet.
7. Vibration Within the limits specified in ISO 2372or equivalent.
8. Protection Overload and short circuit protection to be provided as standard. Further the electronic hardware shall be protected against lightning induced surge.
9. Main Display:
   a. Type LCD Display with back light for clear visibility at day/night.
   b. Character/Digit height(minimum) Volume/Amount : 1".
   c. Unit price : ¾" .
   d. Display Cover Plain Glass.
   e. Units Volume : l (Gal).
   f. Price: $ (Dollars).
   g. Unit Price Minimum 5 Digits including 2 decimals. ($. 0.01 – 999.99).
   h. Volume Preset Standard Duty ->0.5 – 999 Gal.
   i. Standard Duty -> 1 – 999 Gallons.
   j. Price Preset (Cash) Minimum 5 Digits ($0.50 – 99999)
   k. Volume Display Minimum 6 Digits including 3 decimals. 0.000 – 999.999 Gal
   l. Price/Cash Display Minimum 8 digits including 2 decimal Dollars ($.) 0.00 – 999999.99
10. Keypad with LCD Display: Keypad and back lit LCD display shall be IP 65 rated. Amount, Volume preset data shall be entered using keypad. Unit price and pump settings shall be edited from keypad with password and key protection.
11. Flow Meter/Metering Unit
    a. Type Positive Displacement piston type volumetric meter with stainless steel seamless liners and corrosion resistant materials.
    b. Least Measurement 0.01 l
    c. Pulser 100 pulses/Gal (minimum)
    d. Calibration Adjustment Mechanical/Electronic

e. Flow Control Valve Solenoid operated two stage or better flow control valve certified by UL or FM

12. Dispenser Cabinet:
    a. Material Galvanized steel EN10142 with powder coatings (Electrostatic coating).
    b. Panel Covers Shall be Epoxy Coated Steel.
    c. Panel Locks Durable Panel key Locks shall be provided.
    d. Approximate Dimensions 40 inch x 20 inch x 80 inch.
    e. Color of the Panel covers should be white. Otherwise CPC product color code will be noticed at the time of ordering.
13. Hose, Nozzle and Configuration:
    a. Nozzle Automatic Shut off Nozzle (¾" BSPT female thread preferred) Spout Diameter 16 mm
    b. Hose:
    c. Diameter = ¾ inch
    d. Wall Thickness = 0.24 -inch
    e. Minimum Length = 13 feet
    f. Couplings = ¾ -inch NPT chrome plated brass swivel couplings, male thread at one end and female thread at the other end

E. Submersible Turbine Pumps:
1. Pumping Unit and Components:
    a. Turbine type pump with bypass valve.
    b. Flow = 52 GPM @ 10 PSI.
    c. Required NPSH (Net Positive Suction Head) = 4-inches above pump inlet Strainer – The pumping unit shall be equipped with a suction side strainer having reinforced, corrosion resistant screen for use with Motor Gasoline/Auto Diesel. It shall be easily removable for cleaning or replacement.
    d. Air Separator and release – The pumping unit shall be equipped with as air eliminator unit and venting shall comply with the requirement of ANSI/UL 87 or equivalent.
    e. Pressure Relief Devices – Pumping unit shall be equipped with a manual or self-adjusting bypass valve capable of bypassing the entire output of the pump and fuel expansion pressure relief valve.
    f. Check Valve – The pumps shall be provided with check valve to keep the discharge lines full of fuel.
    g. Material of Construction – The material used in the construction of external parts of the pumping unit shall not contain more than 7.5 % Magnesium according to EN13463-1 clause 8.2 – Non- electrical equipment for use in potentially explosive atmosphere part 1-Basic Methods & Requirements.
2. Electric Motor:
    a. Capacity(minimum) 0.75 Hp (Standard Duty).
    b. Duty Cycle Continuous.
    c. Hazardous area Certification Zone 1, Gas Group II A according to IEC.
    d. Standards & Codes Applicable The motor shall be manufactured according to ANSI, NFPA, NEC, API, IEEE, NEMA, BS, IEC, VDE or any other equivalent International standards.

F. Underground Storage Tank Alarms, Sensors and Probes:
1. Sensor Alarm Console for tank overfill protection and sensor leak detection.
2. Remote audible and visible alarm unit for use with automatic tank gauges.
3. Electronic Line Leak Detectors
4. Leak Detection and Inventory Control Probes
5. Moorman Level Gauge Kit
6. Water & Phase Separation Detection Float Kit

7. Hydrostatic interstitial Brite™ sensor detects leaks in double wall tanks where the interstitial space is filled with a liquid brine solution.
8. Fast acting discriminating sensor that utilizes magnetostrictive technology to provide reliable monitoring of dispenser pans and containment sumps. Float sensors detect the presence of water or hydrocarbons.
9. High tank level sensor overfill prevention switch compatible with fuel management system consoles.
10. Turbine pump interface, with communication link for intelligent pump controllers, to communicate faults to enabled devices. This link allows the INCON ATG to include the reporting of submersible pump conditions to a monitoring party or to the station operator.

G. Fuel Management System
1. Product Criteria:
   a. Number of tanks monitored: 12
   b. Number of lines monitored: 8
   c. Sensor input channels: 12
   d. Dry contact input channels: 2
   e. AC input channels: 12
   f. 4-20 ma input channels: 8
   g. Relay output channels: 2
   h. Display type: colour LCD touch screen
   i. Printer type: thermal
   j. Internal audible alarm
   k. Alarm, warning and power LEDs
   l. Applicable liquids: petroleum,
   m. chemicals and hazardous waste
   n. Level units: inches
   o. Volume units: gallons (mass with density option)
   p. Display size: 7"
   q. Power requirements: 110 to 240
   r. VAC, 60 hz, 2.6 Amps
   s. Operating temperature: 32° to 104°F
   t. Humidity: 0-90% non-condensing
   u. Dimensions: 11" x 11.75" x 9.5"
   v. Interface to devices with intrinsic safety rating:
   w. US - Class I, Div. I, Group D
2. Connectivity
   a. Ethernet/complete web interface
   b. RS-232/485
   c. USB
   d. Fax/data modem
   e. IFSF via Echelon
3. Capabilities
   a. Inventory and delivery management
   b. Leak detection sensors
   c. Static and Continuous tank testing
   d. Static and Statistical Electronic Line
   e. Leak Detection
   f. High, low and water alarm set points
   g. Inventory reconciliation / tank autocalibration
   h. Density and mass measurement
   i. Secondary Containment
   j. Monitoring (vacuum)
   k. Turbine Pump Interface (TPI)

l. Email notifications
m. Back-up generator monitoring /fuel flow control

4. Internal Hardware
   a. Internal dispenser interface module, dispenser interface cable must be ordered separately
   b. EcheLON communication module, IFSF protocol capability
   c. Internal modem, includes fax and data software capability
5. Internal Software
   a. Statistical Continuous Automatic Leak Detection, 24-hour continuous tank testing software
   b. Tank inventory reconciliation and auto calibration
   c. Electronic line leak detection
   d. Secondary containment monitoring
6. Approvals
   a. UL, cUL, ATEX, IECEx
   b. Third party certification of leak detection capabilities

PART 3 - EXECUTION

3.1 WORK SEQUENCING RESTRAINTS

A. Prior to receipt of the Owner-Furnished Equipment at the Kennebunk Southbound and Northbound service station sites, the Contractor shall have completed certain elements of the work at those sites. The purpose of this sequencing restraint is to minimize the time the Equipment sits at the site prior to its startup. The general elements of the Work to be completed are listed below. This sequencing restraint will require that the site be made ready to install the Equipment required to provide "temporary fueling operations," prior to demolition of the existing fuel system. The Contractor shall factor this into the sequencing of the Work. The Contractor shall submit a final sequencing plan within 30 days of contract award. The general Sequence of Work shall consist of the following:

B.

1. Kennebunk Southbound service station site (SB):
   a. Contractor shall coordinate with the Resident for the final delivery date of the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems). Owner is currently scheduled to receive tanks and dispensers for Southbound no later than September 5, 2018. Contractor is responsible for crane and off-loading tank, bearing pad for the temporary tanks, and providing proper electrical and communication service to the tank and dispenser locations and the Temporary Fuel System Kiosks. All wire runs shall be underground and meet all applicable National and State Codes.
   b. Contractor shall coordinate with the Resident and CN Brown for CN Brown's delivery of a temporary kiosk; to be located generally between the temporary gas and diesel tanks.
   c. Contractor shall coordinate with the Resident for the final delivery date of the Owner-Furnished and CN Brown-Furnished Equipment (Underground Fuel Systems). Contractor is responsible for crane, off-loading equipment and installation,
   d. Contractor to install the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems), test and commission them prior to demolition of the existing fueling systems. Contractor shall provide Resident and CN Brown with 10 days' notice of Aboveground Fuel System installation, then coordinate with CN Brown for the Point-of-sale connections and all final testing. Contractor shall provide certified

staff for testing and commissioning and shall provide Owner with required information for tank registration.

e. Once the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems) are operational and accepted by the Owner at the SB site, Contractor shall coordinate demo of the existing (Underground Fuel Systems) dispensers with CN Brown for CN Brown to demo. Contractor to demo the balance of the existing (Underground Fuel Systems) and install the new fuel systems, consisting but not limited to underground tanks, dispensers, pumps, electrical, communication, alarms, sensors and probes and fuel management systems..

f. Once the new SB fuel systems are installed, tested, commissioned, operational and accepted by the Owner, Contractor shall decommission the Aboveground tanks and dispensers, relocate the Temporary Fuel Systems to the MTA Kennebunk Maintenance Facility. In the spring of 2019, the contractor shall relocate the Temporary Fuel Systems to the NB site, install them, test, and commission them.

2. Kennebunk Northbound service station site (NB):

a. Contractor shall coordinate with the Resident for the final delivery date of the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems). In addition, Contractor is responsible for crane and off-loading tank, bearing pad for the temporary tanks, and providing proper electrical and communication service to the tank and dispenser locations and the Temporary Fuel System Kiosks. All wire runs shall be underground and meet all applicable National and State Codes.

b. Contractor shall coordinate with the Resident and CN Brown for CN Brown's delivery of a temporary kiosk; to be located generally between the temporary gas and diesel tanks.

c. Contractor shall coordinate with the Resident for the final delivery date of the Owner-Furnished and CN Brown-Furnished Equipment (Underground Fuel Systems). Contractor is responsible for crane, off-loading equipment and installation,

d. Contractor to install the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems), test and commission them prior to demolition of the existing fueling systems. Contractor shall provide Resident and CN Brown with 10 days' notice of Aboveground Fuel System installation, then coordinate with CN Brown for the Point-of-sale connections and all final testing. Contractor shall provide certified staff for testing and commissioning and shall provide Owner with required information for tank registration.

e. Once the Aboveground Fuel Tanks and Fuel Dispensers (Temporary Fuel Systems) are operational and accepted by the Owner at the NB site, Contractor shall coordinate demo of the existing (Underground Fuel Systems) dispensers with CN Brown for CN Brown to demo. Contractor to demo the balance of the existing (Underground Fuel Systems) and install the new fuel systems, consisting but not limited to underground tanks, dispensers, pumps, electrical, communication, alarms, sensors and probes and fuel management systems.

f. Once the new NB fuel systems are installed, tested, commissioned, operational and accepted by the Owner, Contractor shall decommission the Aboveground tanks and dispensers and relocate the Temporary Fuel Systems to the MTA Kennebunk Maintenance Facility.

3. Kennebunk SB & NB service station sites:

a. Contractor shall provide traffic control, perform survey and utilities locates to confirm areas of concern are free of interferences and complete required earthwork, paving, paving sealant, striping, bollards, walk and drive lanes, curbs and containment.

b. Contractor shall notify the Resident of all items considered to cause interference with the Work. Upon approval from Resident, the contractor shall relocate interference items such as the trash container. Contractor shall install temporary

concrete barriers for traffic flow to the temporary fueling and to cordon off the work area as generally shown on the plans. Contractor shall coordinate with the Resident to protect existing items to remain in place such as the generator.

c. Install or modify a construction fence at the site, to protect the work and protect the public from entering the work areas. If required for access, a portion of the fence may be left down, but the fence shall be installed, at least temporarily, by the end of the day until the respective work is finished.

d. Complete the modifications to the electrical service, as needed, to power the temporary fuel system (AST) and Kiosks without interrupting operations for the existing fueling system.

e. Install the required conduit runs from the electrical, instrumentation, controls and communications services. Stub up and temporarily cap prior to setting the Equipment requiring power. Connection of conduits to the Equipment and pulling of conductors to and termination of conductors at the Equipment shall be completed after the Equipment is set.

f. Upon completion of the new fuel systems commissioning, Contractor shall reposition temporary concrete barrier to move traffic back to the new system, to complete all remaining site work, and to decommission the Aboveground Fuel Tanks and Dispensers.

C. Contractor shall submit a Work Sequencing Plan to the Resident for review and approval 21 days prior to construction. The contractor shall coordinate with the Owner and fuel supplier during this notice period to allow fuel provider to plan for maximum depletion of fuel in the tanks, disposition plan of Owner/Fuel Supplier equipment, and staffing needs for Temporary fuel service.

3.2 INSTALLATION

A. The contractor shall have properly certified staff on-site overseeing the installation. This includes: certified tank installers, dispenser installers, monitoring system installers, electricians, and all other certified individuals required by the Regulatory Agencies and the manufacturers of equipment being installed.

B. Install Equipment in conformance with Owner-furnished product shop drawings and installation instructions.

C. Per section 23 11 13, Provide interconnecting structures, equipment, piping, electrical, instrumentation, controls and communications work, finish painting, and all appurtenances to achieve a complete and functional system.

D. Provide foundation pads and bedding (Aboveground and Underground tanks respectively) for Owner-furnished Equipment as shown on the Performance Documents. Verify dimensions and configuration of pads, including penetrations, with Owner-furnished product Shop Drawings. Contractor to pour and cure concrete pads for the UST including full anchor pads, depending on soils conditions. Contractor design to confirm UST tie-down requirements based on geotechnical study. Deadman anchors are highly recommended.

E. Anchor Bolts:

1. Where required, provide anchor bolts, fasteners, washers, and templates required for installation of Owner-furnished Equipment.
2. Size and locate anchor bolts in accordance with Owner-furnished Equipment Shop Drawings and installation instructions.

F. Mechanical and electrical equipment shall be properly aligned, plumb and level, with no stresses on connecting piping or conduit.

G. Install vibration insulators when finished with Owner-Furnished Equipment.

H. Verify operability and safety of electrical system needed to operate Equipment. Check electrical system for continuity, phasing, grounding, and proper functions.

3.3 FIELD FINISHING

A. Equipment will be delivered with prime and finish coat(s) applied.
   1. Touchup or repair damage to coatings resulting from unloading, storage, installation, testing, and startup.
   2. If finish coats are damaged extensively after transfer, completely repaint.
   3. Touchup, repair, or complete repainting shall match color of original paint, and shall be fully compatible with applied primers and finish.

3.4 PRODUCT PROTECTION

A. Immediately after installation, lubricate components in accordance with manufacturer's instructions.

B. Follow manufacturer's instructions for protection and maintenance during storage, after installation, during testing and startup, and after startup but prior to acceptance.

C. Furnish incidental supplies including lubricants, cleaning fluids, and similar Equipment as needed for protecting and maintaining the Owner-furnished Equipment.

D. Supplier will furnish diesel and gasoline fuel for Equipment during startup. Contractor shall furnish diesel and gasoline fuel needed to run the "temporary fuel system" prior to startup.

3.5 TESTS AND INSPECTION

A. Tests and inspections of installed Equipment shall be in accordance with requirements shown below.
   1. Licensed Installer will inspect installation and issue a Certificate of Proper Installation prior to testing. Contractor shall remedy deficiencies noted by Licensed Installer associated with the work performed by the Contractor.
   2. Functional Test: Assist Licensed Installer in performing functional test to verify Equipment runs within its allowable limits, that unit's safety devices function, and that the dispensers transfer fuel to a vehicle.
   3. Performance Test: Assist Licensed Installer in performing test to verify rated output of pumps and dispensers.
   4. Contractor to provide assistance during testing to correct installation issues relating to the Contractor scope of Work. As a minimum, the Contractor's electrician shall be present during the Functional Test and for the Performance Test until the temporary fuel system is operating within the Licensed Installer's rated performance criteria.

3.6 Owner-Furnished Equipment

A. The following drawings are provided for reference.
   1. 5,000 gallon Aboveground Tank and Dispensers.
   2. 15,000 gallon Aboveground Tank and Dispensers.
   3. 20,000 gallon Underground Tanks, Sumps and Sump Covers.

3.7 Method of Measurement

The Underground Tank Installation – Gas and Diesel (SB Plaza) will be measured as one Lump-Sum unit for, but not limited to: design, off-loading, setting, providing and installing complete fuel delivery and monitoring systems, electrical and communications supply and connection, point-of-sale coordination, testing, and commissioning, for a complete functioning fuel system.

The Underground Tank Furnishing and Installation – Gas and Diesel (NB Plaza) will be measured as one Lump-Sum unit for, but not limited to: design, providing and setting tanks, sumps and lids, providing and installing complete fuel delivery and monitoring systems, electrical and communications supply and connection, point-of-sale coordination, testing, and commissioning, for a complete functioning fuel system.

The Aboveground Diesel Tank Installation SB and NB Plazas will be measured as Lump-Sum units for, but not limited to: off-loading, setting, electrical and communications supply and connection, point-of-sale coordination, testing, commissioning, decommissioning, loading, transporting, and downloading a complete functioning temporary fuel system.

The Aboveground Gas Tank Installation (SB and NB Plazas) will be measured as Lump-Sum units for, but not limited to: off-loading, setting, electrical and communications supply and connection, point-of-sale coordination, testing, commissioning, decommissioning, loading, transporting, and downloading a complete functioning temporary fuel system.

The Aboveground Tank decommissioning and relocations, for both gas and diesel will not be measured for payment but will be incidental to the appropriate Aboveground Tank Installation pay item; that is the decommissioning at SB site, loading, and transporting to MTA Kennebunk Maintenance Facility for storage shall be part of the SB Plaza pay item and the loading, transporting to NB site, off-loading, setting, electrical and communications supply and connection, coordination, testing, commissioning a complete functioning temporary fuel system at the NB site, then decommissioning at NB site, loading, and transporting to the MTA Kennebunk Maintenance Facility for storage shall be part of the NB Plaza pay item.

Any tank, dispenser, or other Owner-Furnished Equipment lost or damaged by the Contractor shall be replaced by the Contractor at no additional cost to the Authority.

3.8 Basis of Payment

Underground Tank Installation, Underground Tank Furnishing and Installation, and Aboveground Tank Installation will be paid for at the contract lump sum price, complete in-place. Payment shall include all required design, design reviews, and coordination with Owner for delivery of Owner-Furnished Equipment and for delivery of the Owner-Furnished Equipment to the MTA Kennebunk Maintenance Facility.

Payment will be made under:

800.03	Underground Tank Installation - Gas and Diesel (SB Plaza)	Lump Sum
800.04	Underground Tank Installation Gas and Diesel (NB Plaza)	Lump Sum
800.05	Aboveground Diesel Tank Installation (SB Plaza)	Lump Sum
800.06	Aboveground Diesel Tank Installation (NB Plaza)	Lump Sum
800.07	Aboveground Gas Tank Installation (SB Plaza)	Lump Sum
800.08	Aboveground Gas Tank Installation (NB Plaza)	Lump Sum

END OF SECTION

SECTION 35 02 22 - FUELING SYSTEM - EXCAVATION, BEDDING, AND BACKFILL

Part 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY OF WORK

A. This item covers excavation, backfill, disposal, placement, and compaction of all materials within the limits of the work required to install the fuel piping system, underground structures, as well as other areas for drainage, or for other purposes in accordance with these specifications and in conformity to the dimensions and typical section(s) shown on the plans. In addition, this item covers procedures for addressing contaminated soils.

B. This item shall also include all required quality control and material acceptance sampling and testing in accordance with this specification. The Engineer may perform any additional quality assurance testing that is deemed necessary to verify the Contractor's test results and ensure compliance with applicable specifications.

1.3 RELATED WORK

A. Carefully examine all the Contract Documents for requirements that affect the work of this section.

B. Other specifications, which directly relate to the work of this section, include but are not limited to the following:

1.	23 11 13	Facility Fuel Piping
2.	35 15 60	Fueling System Demolition

1.4 QUALITY CONTROL

A. General:

1. The Contractor shall employ a certified independent testing facility to perform all laboratory and field material acceptance sampling and testing. The Contractor shall provide the Engineer with a certification stating that all the testing equipment to be used is properly calibrated and will meet the applicable specifications for the specific test procedures. The independent testing facility and personnel shall be subject to the approval of the Engineer.

B. Testing Requirements:

1.	ASTM D 698	Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-pound Rammer and 12-Inch Drop
2.	ASTM D 1556	Test for Density of Soil in Place by the Sand-Cone Method

3.		ASTM D 1557 Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 10-pound Rammer and 18-Inch Drop
4.	ASTM D 2167	Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

C. Definitions and Reference Standards:

1.		ASTM American Society for Testing and Materials
2.		ACI American Concrete Institute
3.		EPA Environmental Protection Agency
4.	DEP	Department of Environmental Protection

1.5 WORK CLASSIFICATION

A. Types of Excavation:

1. Trench Excavation:

a. Trench excavation shall consist of excavating a trench to install fuel piping, drainage piping, or electrical ducts in accordance with the details shown on the drawings.

2. Excavation for Underground Structures:

a. Excavation for underground structures shall consist of excavating a pit of sufficient size to install fuel piping, tanks, manholes, handholes, etc. as shown on the drawings.

B. All material excavated shall be classified as defined below:

1. Suitable Materials:

a. Suitable materials from trench and structure excavation shall be re-used on-site in formation of embankments or disposed of at a site designated by the Owner. Any temporary stockpiling or rehandling of this material required for reuse is considered a subsidiary obligation and no separate measurement or payment shall be made for temporary stockpiling or rehandling suitable trench excavation material. Any excess suitable material from trench or structure excavation not used for other purposes shall be disposed of at Owner designated site.

2. Unsuitable Materials:

a. Any material from trench and structure excavations containing vegetable or organic matter, such as muck, peat, organic silt, or sod

shall be considered unsuitable for reuse as trench backfill or formation of embankments. Unsuitable excavated material shall be legally disposed of off airport property.

3. Trench Over-Excavation:

a. Trench over-excavation shall consist of removing unsuitable material below the subgrade lines to build a suitable subgrade for utility lines as directed by the Engineer. Trench over-excavation completed by the Contractor without prior approval by the Engineer will not be measured for payment. The costs associated with any unauthorized over-excavation and subsequent backfill shall be the sole responsibility of the Contractor.

4. Backfill for Trench Over-Excavation:

a. Backfill for trench over-excavation shall consist of placing and compaction of Underdrain Backfill Material in accordance with Table 1 within the trench over-excavation limits.

Table 1.
Gradation Requirements
Foundation Stabilization Material

Sieve Designations (Square Openings)	Percentage by Weight Passing Sieves
1 inch	95-100
½ inch	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5.0

1.6 JOB CONDITIONS

A. Site and Subsurface Conditions:

1. The Contractor is advised that:

a. Dewatering may be required due to the high groundwater table.

b. Remains of foundations and slabs of structures, other miscellaneous rubble, and trash may be present below grade.

1.7 PROTECTION OF UNDERGROUND FACILITIES

A. The Contractor's attention is directed to the necessity of making investigations to assure that no damage to existing structures, drainage lines, navigational signal conduits, electrical ducts, fuel lines, etc. will occur.

1.8 DELIVERY, STORAGE, AND HANDLING

A. All excess excavated material, regardless of its nature shall be disposed of legally off property except for potentially contaminated materials which shall be transported to the holding area designated by the Engineer.

B. Temporary storage of excess excavated material may be permitted with prior approval of the Engineer, however, the surface elevation of stockpiled material shall not extend above the surface elevation of adjacent pavement areas unless approved by the Engineer.

1.9 SUBMITTALS

A. Submit to the Engineer for approval complete working drawings showing the method of trench excavation and valve pit excavation, method of excavation support, and dewatering techniques that are proposed to be used. The following is not intended to limit, but to provide, the minimum details that must be included in the submittal.

1. Structural analyses detailing the design of shoring and bracing. Submittal data shall be complete with calculations and drawings indicating all structural members to be utilized.

2. Working drawings and design data describing the proposed dewatering system including, but not limited to, the arrangement, locations and depths of dewatering system components, standby equipment and standby power supply, proposed locations of discharge points, and the size and type of dewatering system. The Contractor shall evaluate whether dewatering will cause settlement of the soil outside the excavation, and shall design the dewatering system to minimize such settlements.

3. Excavation support design submittals and ground water control submittals shall be prepared by a Professional Engineer registered in the jurisdiction.

4. The Engineer will review submittals with consideration of requirements of the completed work, utilities, and the possibility of unnecessary delays in the execution of the work to be constructed under this contract. Review of the Contractor submittals by the Engineer shall not be construed in any way as relieving the Contractor of his responsibility for the safety of this method or equipment used, or for his responsibility to satisfactorily complete the work in accordance with the plans and specifications.

Part 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Bedding Material: Bedding material under and around fuel lines shall be natural mineral sand meeting ASTM specification C-33, Fine Aggregate, as shown below.

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves
1/2-Inch	100
3/8-Inch	85-100
No. 4	60-100
No. 16	35-80
No. 50	10-55
No. 100	2-10

1. Suitable imported bedding material shall not contain chlorides that could be deleterious to the pipe and/or coatings.

2. Using suitable materials excavated from the trench that are screened to meet the above gradation is an acceptable alternative for pipe bedding. The soil screened for pipe bedding shall not contain topsoil or organic materials of any kind.

B. The Owner will employ quality assurance procedures to ensure the Contractor's compliance with the above-mentioned testing requirements and procedures.

Part 3 - EXECUTION

3.1 GENERAL

A. Before beginning excavation and trenching operations in any area the Contractor shall verify the location of all utilities and notify the Engineer in writing of any discrepancies.

B. The structural suitability of material to be placed as backfill shall be subject to approval by the Engineer based on test results submitted by the Contractor. All unregulated excess suitable/ unsuitable material shall be legally disposed of off property. All temporary stockpile areas shall be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas shall not extend above the surface elevation of adjacent usable pavement areas unless specified on the plans or approved by the Engineer.

C. If it is necessary to interrupt existing surface drainage, sewers, or under-drains, or similar underground utilities, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. The Contractor shall, at his/her own expense, satisfactorily repair or pay the cost of all damage to such utilities or structures which may result from any of the Contractor's operations during the period of the Contract.

D. Perform all excavations in conformance with "OSHA Standards and Interpretations, Subpart P - Excavation, Trenching, and Shoring" and/or as per typical sections shown on the plans, whichever is stricter.

3.2 TRENCH AND STRUCTURE EXCAVATION

A. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has obtained elevations and measurements of the ground surface. All suitable

excavated material shall be used in the formation of subgrade or for other purposes shown on the plans.

B. The grade shall be maintained so that the surface is well drained always. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water, which may affect the work.

1. Undercutting:

a. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for subgrades, roads, or shoulders shall be excavated to a minimum depth of 12 inches or to the depth specified by the Engineer, below the subgrade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. The excavated area shall be refilled with suitable material obtained from the trenching operations and compacted to specified densities. The necessary refilling will constitute a part of the embankment. Where rock cuts are made, and refilled with selected material, any pockets created in the rock surface shall be drained.

2. Removal of Utilities:

a. The removal of existing structures and utilities required to permit the orderly progress of work shall be accomplished by the Contractor unless otherwise shown on the plans. All existing foundations shall be excavated for at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed. All foundations thus excavated shall be backfilled with suitable material and compacted as specified herein. Backfill is considered incidental to removal of existing structures and utilities and no payment shall be made for this item.

3.3 TRENCH AND STRUCTURE BACKFILL

A. Prepare the bottom of the trench and structure excavation to receive bedding material, pipes, and structures for utilities to be placed in the trenches and per paragraph 3.2.

B. Where the trench crosses an existing utility, the Contractor shall support the utility to prevent damage and maintain utility services. Support methods shall be adequate to maintain the existing utility line in its existing position without sagging or vibrating. Contractor to comply with minimum separation distances between utilities per applicable codes requirements.

3.4 TRENCH OVER-EXCAVATION

A. When the material encountered at the bottom of trench is found to be soft and unsuitable to provide a stable subgrade, the Contractor shall remove and replace unsuitable material with Underdrain Backfill Material, Type B in accordance with Table 1, as directed by the Engineer.

3.5 HAUL

A. All hauling will be considered a necessary and incidental part of the work. Its cost shall be considered by the Contractor and included in the contract unit price for the pay items of work involved. No payment will be made separately or directly for hauling on any part of the work.

3.6 PETROLEUM CONTAMINATED SOIL

A. Areas of contaminated soil may exist within the work area.

B. Oversight: Contractor shall provide Owner 48 hours notice of construction activities in areas of known contamination. Owner will provide oversight during activities in areas of contaminated soil. Oversight will consist of observing soil conditions, collecting soil samples for field screening and possible laboratory analysis, and designating excavated material for appropriate stockpiling. The observer will not direct the work, but will provide the appropriate instruments and expertise to identify soil that requires special handling in accordance with the specifications. Contractor shall assist the observer by allowing collection of soil samples from the excavator bucket or by briefly stopping the work to allow observation or sample collection.

C. Stockpiling: Soil excavated from areas of petroleum contamination shall be segregated into two separate stockpiles. One shall consist of soil without field evidence of contamination. The other shall consist of soil with field evidence of contamination. The observer will designate which stockpile excavated soil shall be placed. Stockpiled soils shall be placed on pavement or plastic (minimum thickness 6 mil) and covered with plastic when not active. Secure plastic covering to keep it in place. Contractor shall make as few stockpiles as possible (to limit the number of chemical tests required), but is not expected to haul soil to reduce the number of stockpiles.

D. Disposal or Re-use of Soil: The soil shall remain in place for a minimum of 48 hours to allow Owner to complete chemical analysis. Owner will then notify the Contractor regarding the final disposition of the soil stockpiles. The stockpiled soil will be designated in one of three ways, as follows.

1. Unrestricted – Soil designated as unrestricted shall be handled by the Contractor in accordance with the specifications for uncontaminated soil.

2. Restricted – Soil designated as restricted must be used as backfill on the project site in a location designated by the Engineer.

3. Disposal – Soil designated for disposal will be headed and hauled to a disposal site designated by Owner. The Owner will complete any necessary analytical testing. The Contractor shall provide 48 hours notice of plans to haul soil to Owner-designated disposal site.

E. Unexpected Contamination: The Contractor shall be on the lookout for unexpected contamination. Upon encountering unexpected contamination, the Contractor shall notify the Owner immediately and the Owner will respond with an on-site observer within 24 hours. The work shall then proceed in the manner described above.

PART 4 - COMPENSATION

4.1 METHOD OF MEASUREMENT

A. Unless otherwise indicated, no separate measurement for payment will be made for the work described in this specification, including trench excavation, structure excavation, trench and structure backfill, haul and disposal, as this work is considered a subsidiary obligation to various associated items.

END OF SECTION 35 02 22

SECTION 35 15 60 - FUELING SYSTEM DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY OF WORK

A. This section covers demolition of the fuel system. Complete demolition shall include, but not be limited to, fuel draining, tank and line cleaning. The fuel system to be demolished is as indicated on the drawings.

1.3 RELATED WORK:

A. 35 02 22 - Fueling System-Excavation, Bedding, and Backfill

1.4 SUBMITTALS

A. Statements:
   1. Spill Prevention and Clean-up Plan:
      a. The Spill Prevention and Clean-up Plan shall be submitted in accordance with State of Maine, Department of Environmental Protection, regulatory requirements. The Contractor is responsible for collecting, testing, labeling, and disposing of all waste. The Spill Prevention and Clean-up Plan shall comply with applicable requirements of federal, state and local regulations including 29 CFR 1910.120 and shall address the following:
         1) Spill prevention, containment, and clean-up contingency measures to be implemented.
         2) The name and number of all persons to be notified in case of a spill.
         3) Locations of shut-off valves.
         4) Record of appropriate training of all personnel to be working in an area where a spill can occur.
   2. Oily Water and Waste Fuel Disposal Plan:
      a. The Contractor shall prepare and submit an Oily Water and Waste Fuel Disposal Plan in accordance with the Special Provisions. The Contractor is responsible for testing, containerizing, labeling and disposing of all waste. The Oily Water and Waste Fuel Disposal Plan shall include the following:
         1) Identification of all waste streams associated with the abandonment of the fuel lines, including a sampling and testing plan, the purpose of each test, and the rationale to evaluate the results. Indicate the sampling methods, testing methods, number of samples, and the name and certification of the testing laboratory.
         2) Proposed method/location of disposal.
         3) List of waste handling equipment to be used in performing the work. Include the equipment used in collection and transporting.
         4) Work plan and schedule for waste removal and disposal.

3. Health and Safety Plan:
   a. The Contractor shall submit a Health and Safety Plan in accordance with the Special Provisions. The Health and Safety Plan shall be prepared, reviewed and signed and sealed by a Certified Industrial Hygienist. The safety plan shall meet OSHA requirements and shall include the following:
      1) Identification and evaluation of the hazards and risks associated with each work task, including precautionary measures to be followed by workers.
      2) Names and qualifications of each Contractor's representative(s) in charge of the work and present at the job site when pipeline draining and filling work will be performed.
      3) Identification of supervisory personnel and alternates responsible for site safety/response operations.
      4) Determination of levels of personnel protection to be worn for various site operations.
      5) List of equipment with adequate nomenclature by item, that will be used at the job site and the date and location where this equipment can be inspected by the Engineer.
      6) Establishment of emergency procedures, such as: escape routes, fire protection, signals for withdrawing work parties from site, emergency communications, wind indicators, including facility notification.
      7) Identification and arrangements with nearest medical facility for emergency medical care for both routine-type injuries and toxicological problems. Submit name, location, and telephone number of this medical facility.
      8) Identification of training plan to be instituted, including contents of 29 CFR 1910.1200 and 29 CFR 1910.134, its training contents and instructor with appropriate training certification.
      9) Establishment of a hazard communication program (20 CFR 1910.1200).

4. Fuel Tank and Line Cleaning Plan:
   a. Submit to the Engineer a detailed description of the fuel tank and piping cleaning procedures required prior to demolition. The Contractor is responsible for providing all equipment necessary as well as the potable water.

1.5 REFERENCED STANDARDS:

A. Applicable Standards:
   1. Comply with applicable provisions of the following unless otherwise indicated or specified.

B. American Society for Testing and Methods (ASTM):
   1. ASTM A 234 - 1991 Piping Fittings of Wrought Carbon Steel and for Moderate and Elevated Temperatures.
   2. Code of Federal Regulations (CFR):
      a. 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response
      b. 29 CFR 1910.1200 - Hazard Communication

1.6 WORK ITEMS:

A. Demolition:
1. Demolition does not mean abandon in place, but total removal including disposal or salvage.
2. The Contractor is required to remove all items within the limits of demolition as shown on the drawings to be removed unless alternatives are noted, and all items directed by Engineer.
3. The removal includes but is not limited to:
a. Buried fuel tanks and concrete support structures.
b. Buried fuel piping and structures.
c. Buried electrical conduit and circuits.
d. Miscellaneous structures.
e. All miscellaneous debris.
4. The drawings are not all inclusive of the items to be demolished. The Contractor is responsible for investigating the site and determining the type and quantity of items to be demolished.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials to be provided by the Contractor for fuel equipment demolition are as follows:
1. Fuel Truck:
a. The Contractor shall provide a clean, uncontaminated truck for removal, collection, and transportation of fuel.
3. Water:
a. Water shall be potable with a pH range of 5 to 8 and shall be free of **deleterious materials.**

PART 3- EXECUTION

3.1 GAS FREE CONDITIONS

A. Clean fuel tanks and piping to be demolished in a Gas Free Condition.

3.2 DEMOLITION

A. Demolish and remove existing work where noted on the Drawings and/or where new work is indicated. Take care to prevent damage to active utilities. Contractor shall be responsible for repairing all damage to active utilities not scheduled for removal, at Contractor's expense.

3.3 FUEL REMOVAL AND DRAINING

A. This section describes the procedures to be used on the existing fuel system to be taken out of service. The Contractor shall provide all labor, equipment, and materials necessary to remove fuel from the system.

B. The Contractor shall submit in writing a request at least ten days prior to scheduling his work and shall have the approval of the Engineer as to the time and date for isolating any fuel line to be drained. Work shall be completed within the time frame specified. Arrangements shall be made for the appropriate fire protection measures to be present during any of the fuel handling procedure. Coordination with the appropriate fuel operator

is required. Any requirements to work hours other than what might be considered normal working hours (0800-1700) shall be done without any increase to contract cost.

C. The Contractor shall obtain all appropriate Hot Work permits from the Fire Department.

D. The Contractor shall locate and identify the proper low point valves associated with the fuel line to be drained. If the pipe section to be drained does not have a low point drain, the Contractor shall provide for the installation of a temporary drain connection. The Contractor shall use a vacuum truck to remove fuel from each tank and line. The Contractor shall provide all labor, materials, and equipment for venting and draining the sections of fuel tank and lines.

E. The Contractor shall provide clean, uncontaminated vacuum tank trucks for collecting and transporting the fuel. The Contractor shall provide testing of the drained fuel to ascertain its quality, and the quality shall be approved by the Engineer for reuse. Any fuel that is not acceptable for return to storage shall be removed and disposed of by the Contractor.

3.4 GUARANTEE

A. The Contractor shall provide guarantees and warranties in accordance with the requirements of the General Conditions.

3.5 Method of Measurement

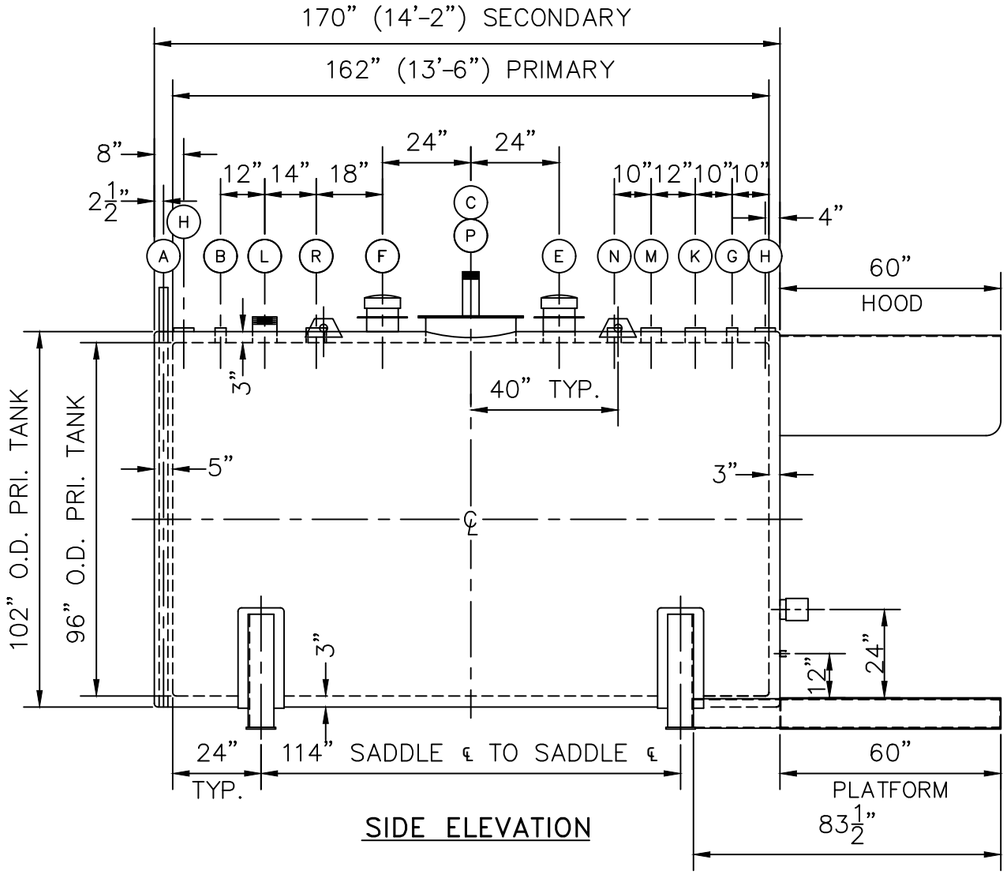
Removal of Underground Tanks – Gas and Diesel will be measured as one lump sum per plaza for, but not limited to: removal of the existing underground tanks, fuel draining, tank and line cleaning and all incidentals necessary to remove the tanks and appurtenances completely.

3.6 Basis of Payment

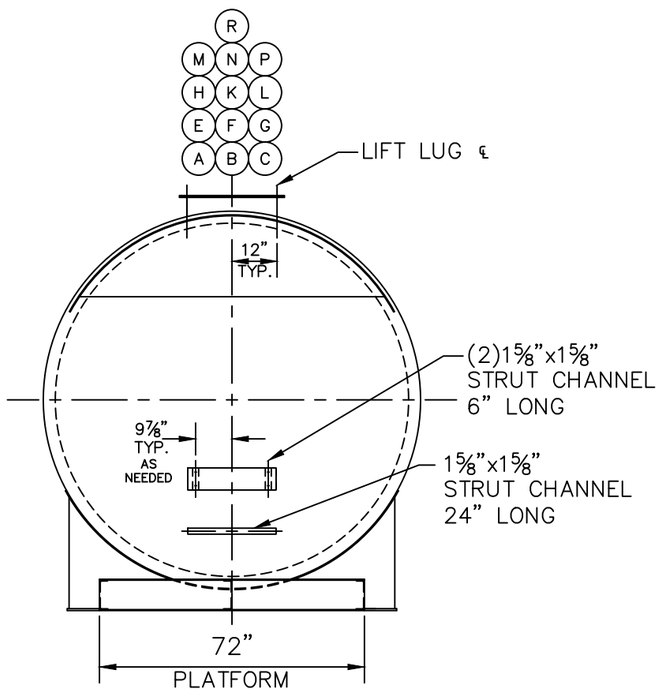
Removal of Underground Tanks – Gas and Diesel will be paid for at the at the contract lump sum price per plaza.

800.01	Removal of Underground Tanks - Gas and Diesel (SB Plaza)	LS
800.02	Removal of Underground Tanks - Gas and Diesel (NB Plaza)	LS

END OF SECTION 35 15 60



SIDE ELEVATION



DISPENSER END VIEW

GENERAL NOTES

FABRICATION PER: UL-142 & UL-2085
LABEL REQUIRED ☒YES ☐NO UL
SHOP TEST: PER UL-142
3-5 PSI AIR WITH SOAP SUDS
INSPECTION BY: MODERN WELDING Q.C.
MATERIAL SHELL: PER UL C.S
FLANGES: A105
SADDLES: A36
INT. APPURTENANCES: C.S.
EXT. APPURTENANCES: C.S.
BOLTS: GR. 5 (ZINC PLATED)
NUTS: GR. 5 (ZINC PLATED)
GASKETS: FULL FACED UL GASKETS
SURFACE PREP EXT.: SSPC-SP6 INT.: NONE
PAINT:
EXT.: SW 4036 MILL IVORY
PER MANUFACTURES RECOMMENDATIONS
INT.: NONE
VENTING CAPACITY (CFH) PRI.: 278,800
VENTING CAPACITY (CFH) SEC.: 297,200
EST. WT. EMPTY: 20,000 LBS.

NOTE:
EMERGENCY VENTING LABELS FOR PRIMARY TANK & ANNULAR SPACE ARE REQ'D. LABEL SHALL BE ATTACHED NEXT TO OR BETWEEN BOTH EMERGENCY VENTS.

ALL FILLET WELDS TO BE 1/4" MIN. UNLESS OTHERWISE NOTED.

ALL NOZZLE AND MANWAY BOLT HOLES TO STRADDLE NORMAL CENTER LINES OR THEIR PARALLEL UNLESS OTHERWISE NOTED.

* EMERGENCY VENTS TO BE SUPPLIED BY MODERN WELDING.

	MARK	REQ'D.	SIZE	ITEM	RATING	TYPE	SERVICE
	R	1	4"	COUPLING	150#	FG	-
	P	1	4"	PIPE NIP	SCH 40	TOE	ELECTRONIC LEVEL
	N	1	3"	COUPLING	150#	FG	VENT
	M	1	4"	COUPLING	150#	FG	SPARE
	L	1	6"	PIPE NIP	SCH 40	TOE	FILL
	K	1	4"	COUPLING	150#	FG	PUMP
	H	2	4"	TANK FLG.	-	CRVD	CONCRETE FILL
	G	1	2"	COUPLING	150#	FG	RETURN
*	F	1	8"	FLANGE ADAPTER	150#	MB	SEC. EMERGENCY VENT
*	E	1	8"	FLANGE ADAPTER	150#	MB	PRI. EMERGENCY VENT
	C	1	24"	PRESSED STEEL	-	STD	MANWAY w/COVER
	B	1	2"	COUPLING	150#	FG	GAUGE
	A	1	2"	PIPE	SCH.40	T.O.E	MONITOR

SCHEDULE OF OPENINGS

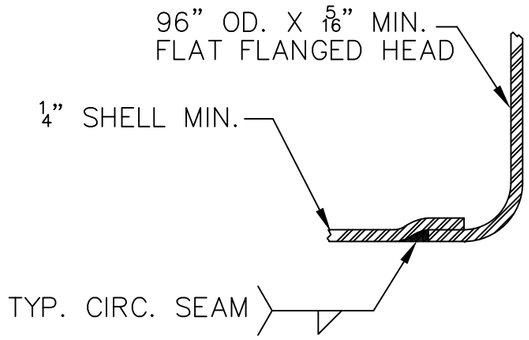
BY	NO	REVISION	DATE
JS/JC	0	ORIGINAL ISSUE FOR APPROVAL	6/5 2018

NO. REQ'D ONE(1) ITEM NO.

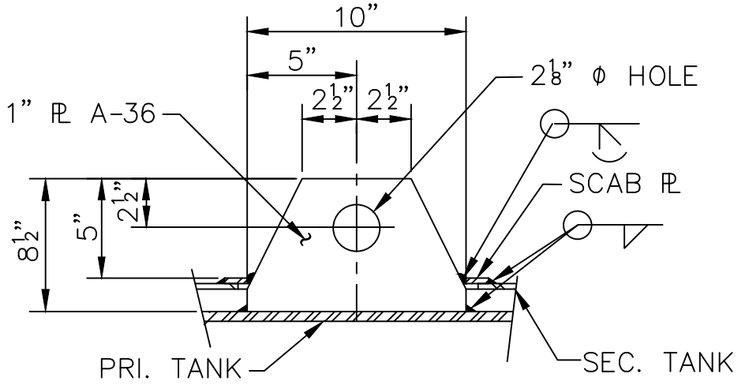
MODERN WELDING CO. of OHIO INC.
P.O. Box 4430
One Modern Way
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
5,000 GALLON FIREGUARD TANK

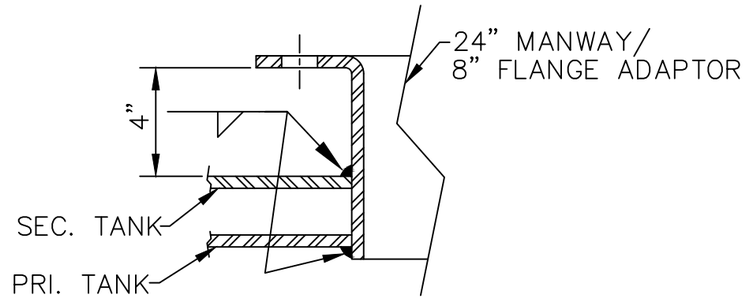
DWN. BY	JS	DATE 6/5/2018	SCALE: NONE
CHK. BY	JC	JOB NO. -	DWG. NO. — 0
APR. BY	-	P.O. NO. -	SHT. NO. 1 OF 5



DETAIL @ PRI. CIRC. SEAM

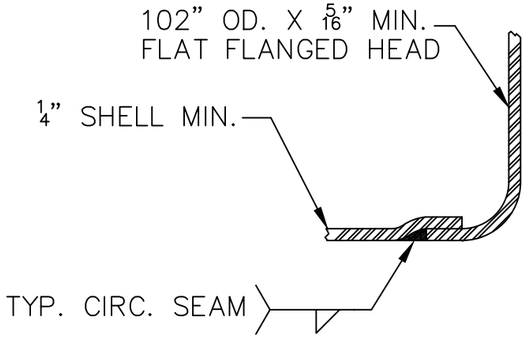


DETAIL @ LIFTING LUG
(4) REQ'D.

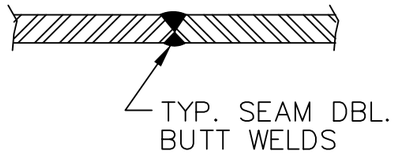


DETAIL @ MANWAY/PRI. EMER. VENT (C)(E)

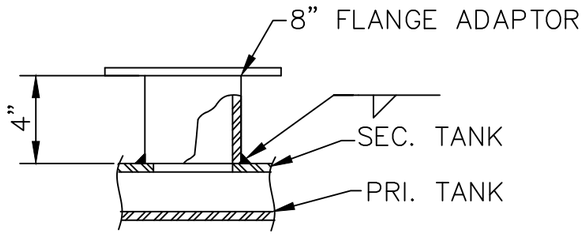
NOTE: CUT PRI. VENT TO CONTOUR OF PRI. TANK



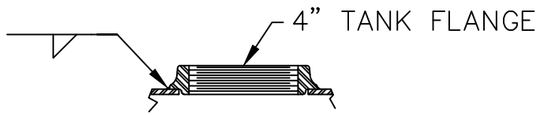
DETAIL @ SEC. CIRC. SEAM



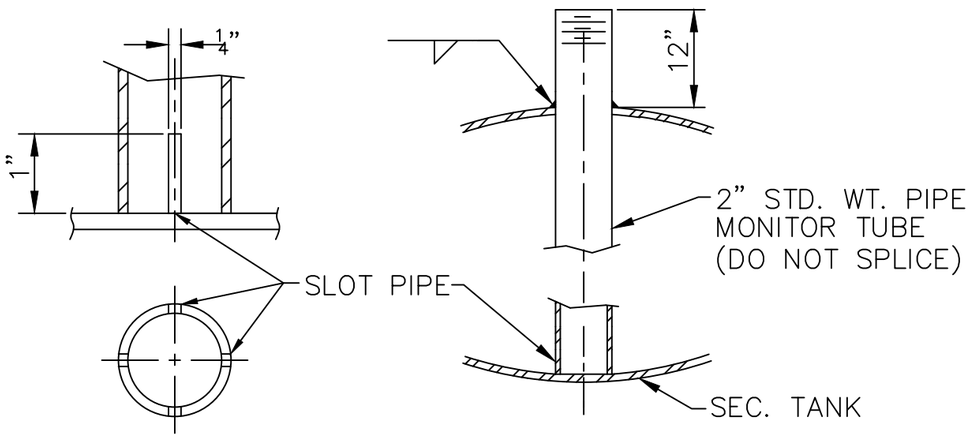
TYP. LONG'T. SEAM



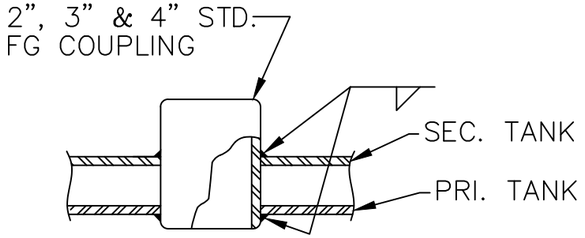
DETAIL @ SEC. EMER. VENT (F)



DETAIL @ TANK FLANGE (H)



DETAIL @ MONITOR PIPE (A)



DETAIL @ COUPLINGS (B)(G)(K)(M)(N)(R)

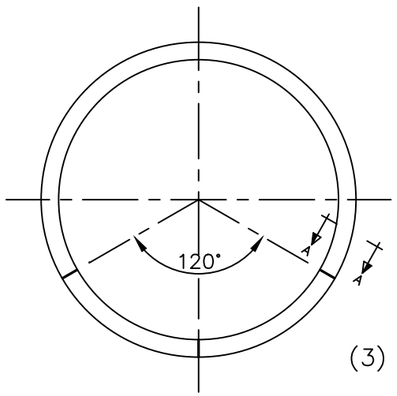
JS/JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
BY/AP	REVISION	DATE	NO

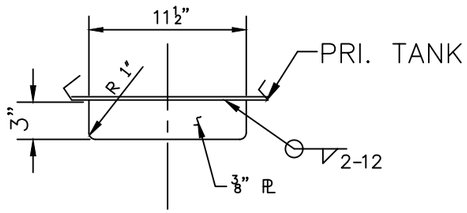
NO. REQ'D ONE(1) | ITEM NO.

MODERN WELDING CO. of OHIO INC.
P.O. Box 4430
One Modern Way
modern
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
5,000 GALLON FIREGUARD TANK

DWN. BY	JS	DATE 6/5/2018	SCALE: NONE	
CHK. BY	JC	JOB NO. –	DWG. NO. –	0
APR. BY	–	P.O. NO. –	SHT. NO. 2 OF 5	

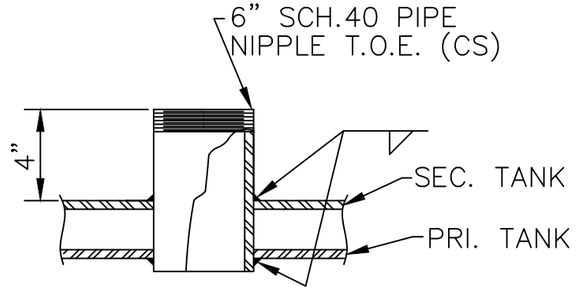




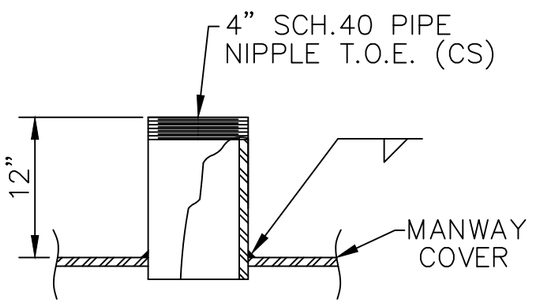
SECTION A–A

(3) REQ'D. CENTERED OVER EACH SADDLE

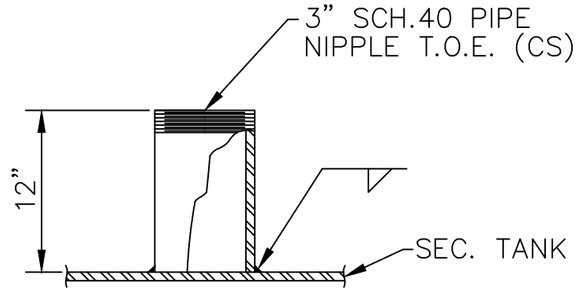
LAYOUT & SPACER PLATES



DETAIL @ FILL (L)

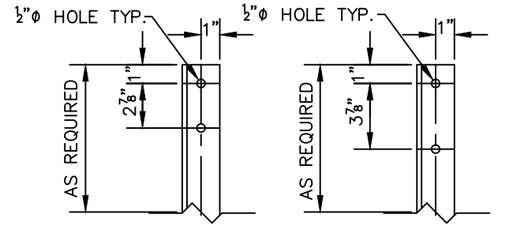


DETAIL @ PIPE NIPPLE (P)



DETAIL @ CABLE SUPPORT

(2) REQ'D

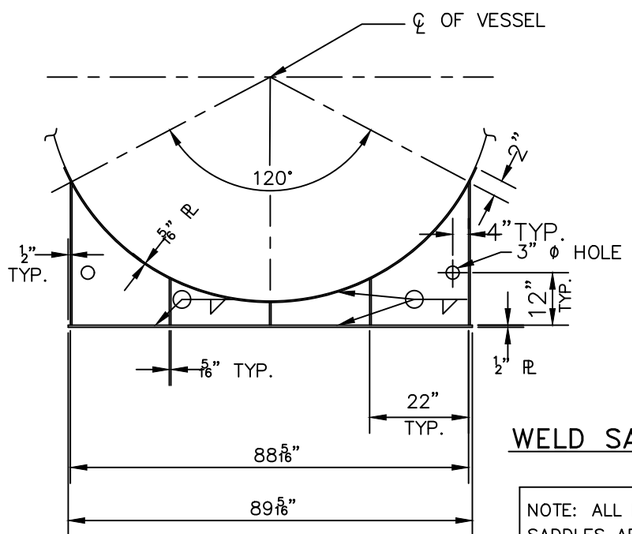


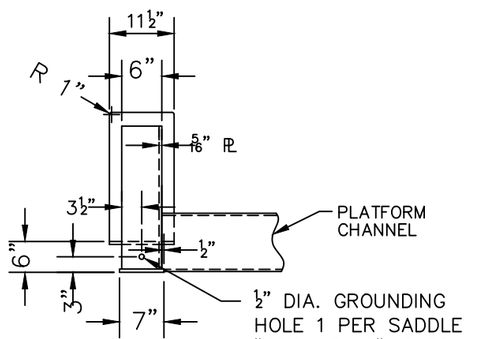
USE FOR ⅜"ϕ X 2 ½" U-BOLTS FOR 2" PIPE

USE FOR ⅜"ϕ X 3 ½" U-BOLTS FOR 3" PIPE

DETAIL @ PIPE SUPPORT

2"x2"x¼" ANGLE





WELD SADDLES TO TANK

NOTE: ALL FILLET WELDS ON SADDLES ARE TO BE 3/16" MIN.

CUSTOMER NOTE: GROUNDING LUG IS TO BE BOLTED AT THIS HOLE

DETAIL @ SADDLE

(2) REQ'D

BY		DATE	NO
JS/JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
BY/AP	REVISION	DATE	NO

NO. REQ'D ONE(1) | ITEM NO.

MODERN WELDING CO. of OHIO INC.

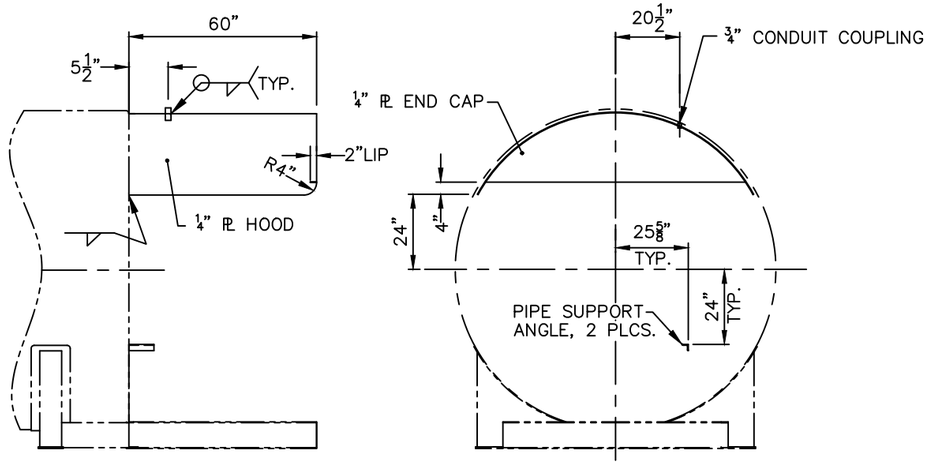
P.O. Box 4430
One Modern Way

modern

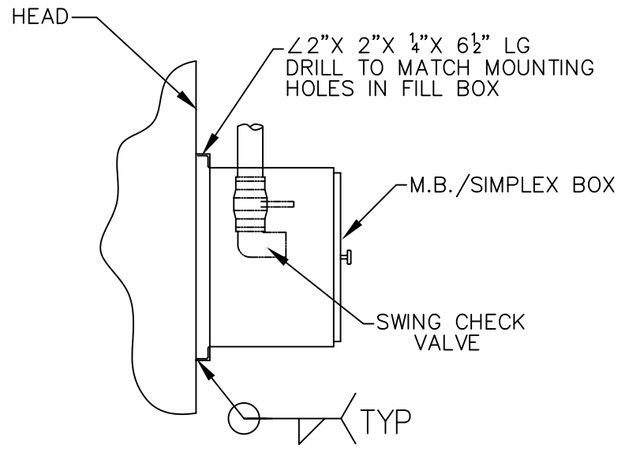
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
5,000 GALLON FIREGUARD TANK

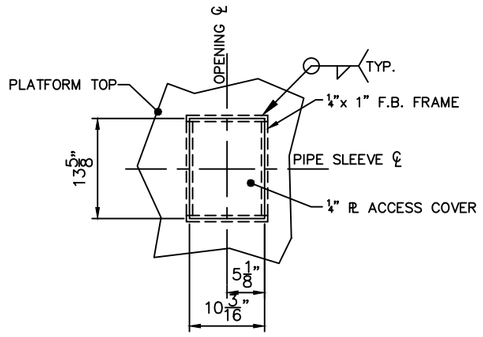
DWN. BY	JS	DATE 6/5/2018	SCALE: NONE
CHK. BY	JC	JOB NO. –	DWG. NO. – 0
APR. BY	–	P.O. NO. –	SHT. NO. 3 OF 5



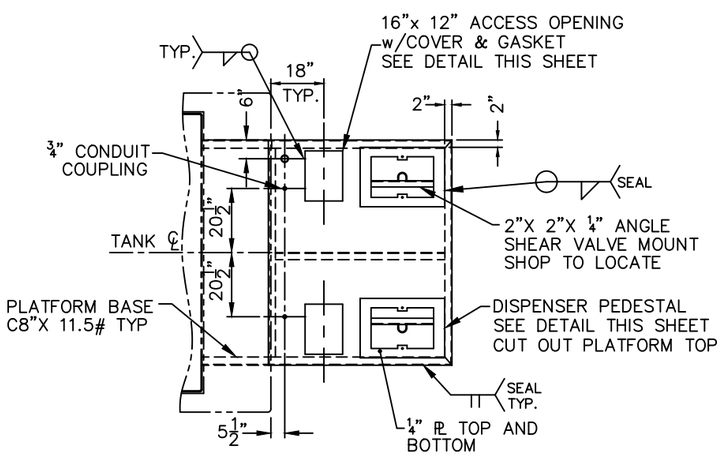
DETAIL @ RAIN HOOD

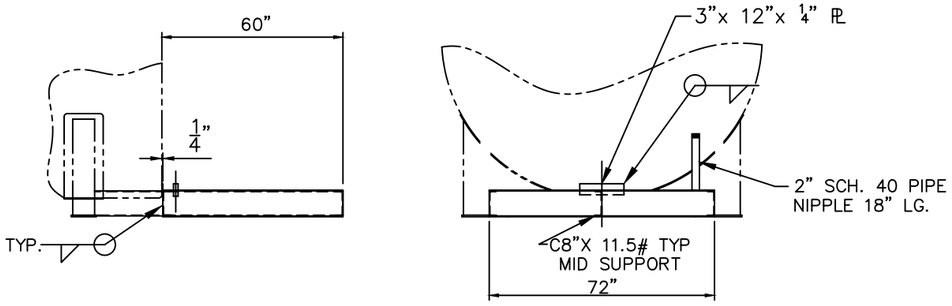


DETAIL @ FILL BOX MOUNTING

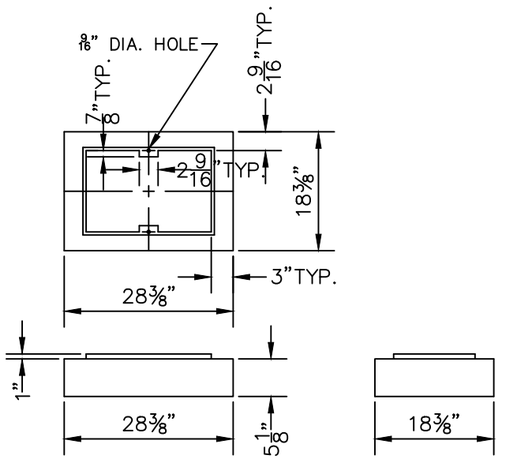


DETAIL @ ACCESS OPENING
(2) REQ'D.





DETAIL @ CONTAINMENT PLATFORM



DETAIL @ PUMP PEDESTAL
(2) REQ'D.
7 GA. MATERIAL

JS / JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
BY / AP	REVISION	DATE	NO

NO. REQ'D ONE(1) | ITEM NO.

MODERN WELDING CO. of OHIO INC.

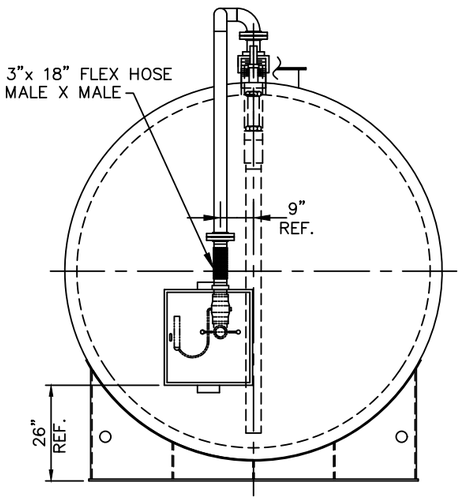
P.O. Box 4430
One Modern Way

modern

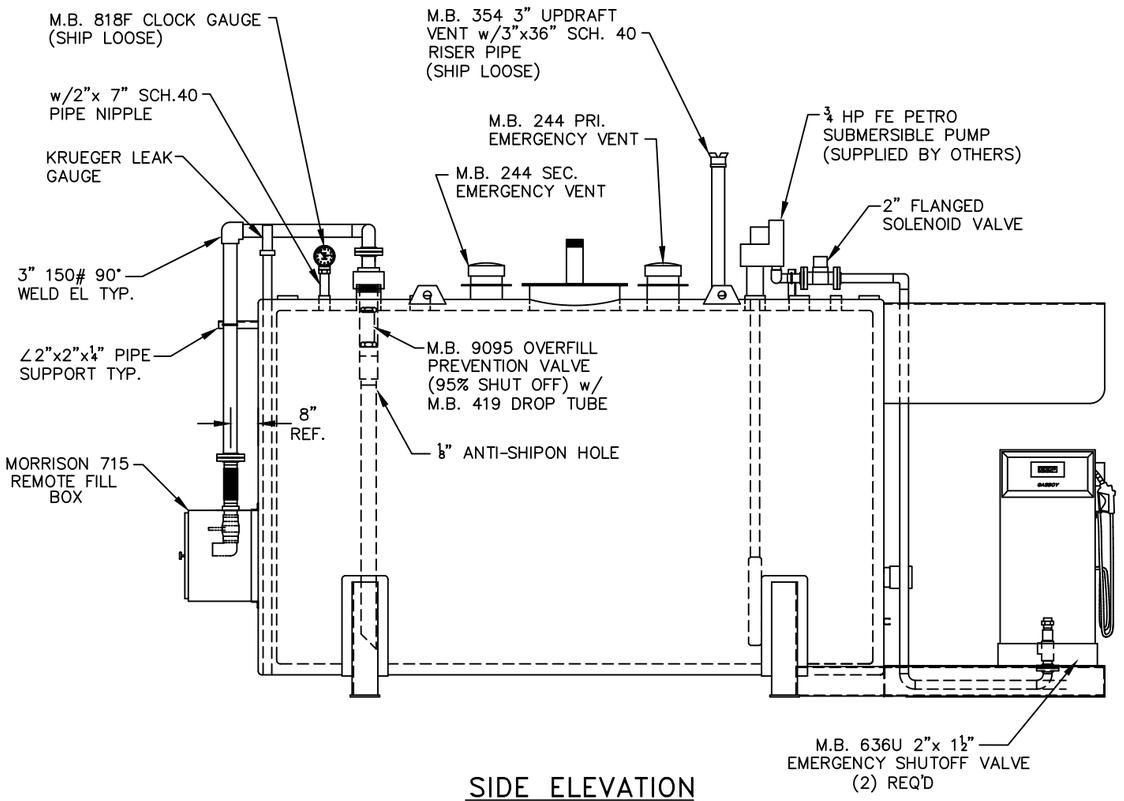
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
5,000 GALLON FIREGUARD TANK

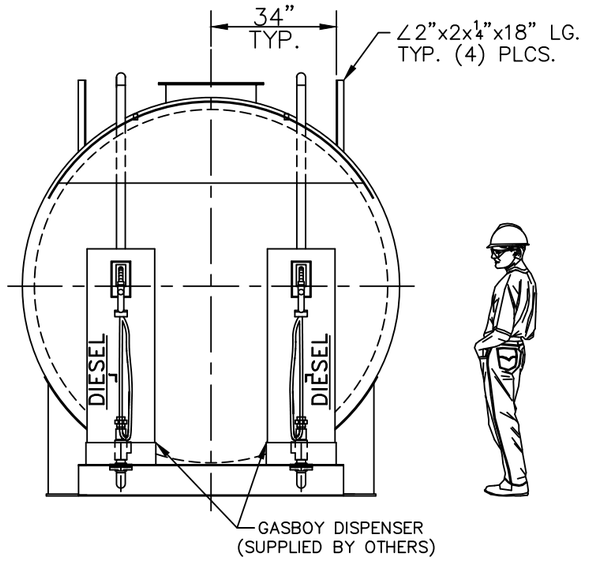
DWN. BY	JS	DATE 6/5/2018	SCALE: NONE
CHK. BY	JC	JOB NO. -	DWG. NO. - 0
APR. BY	-	P.O. NO. -	SHT. NO. 4 OF 5



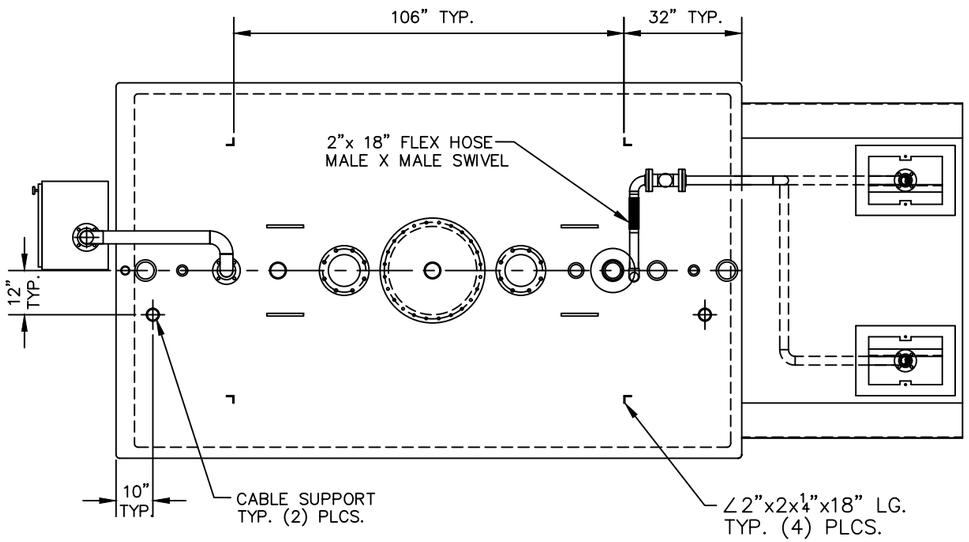
FILL END VIEW



SIDE ELEVATION



DISPENSER END VIEW



PLAN VIEW

JS / JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
BY / AP	REVISION	DATE	NO

NO. REQ'D ONE(1) | ITEM NO.

MODERN WELDING CO. of OHIO INC.

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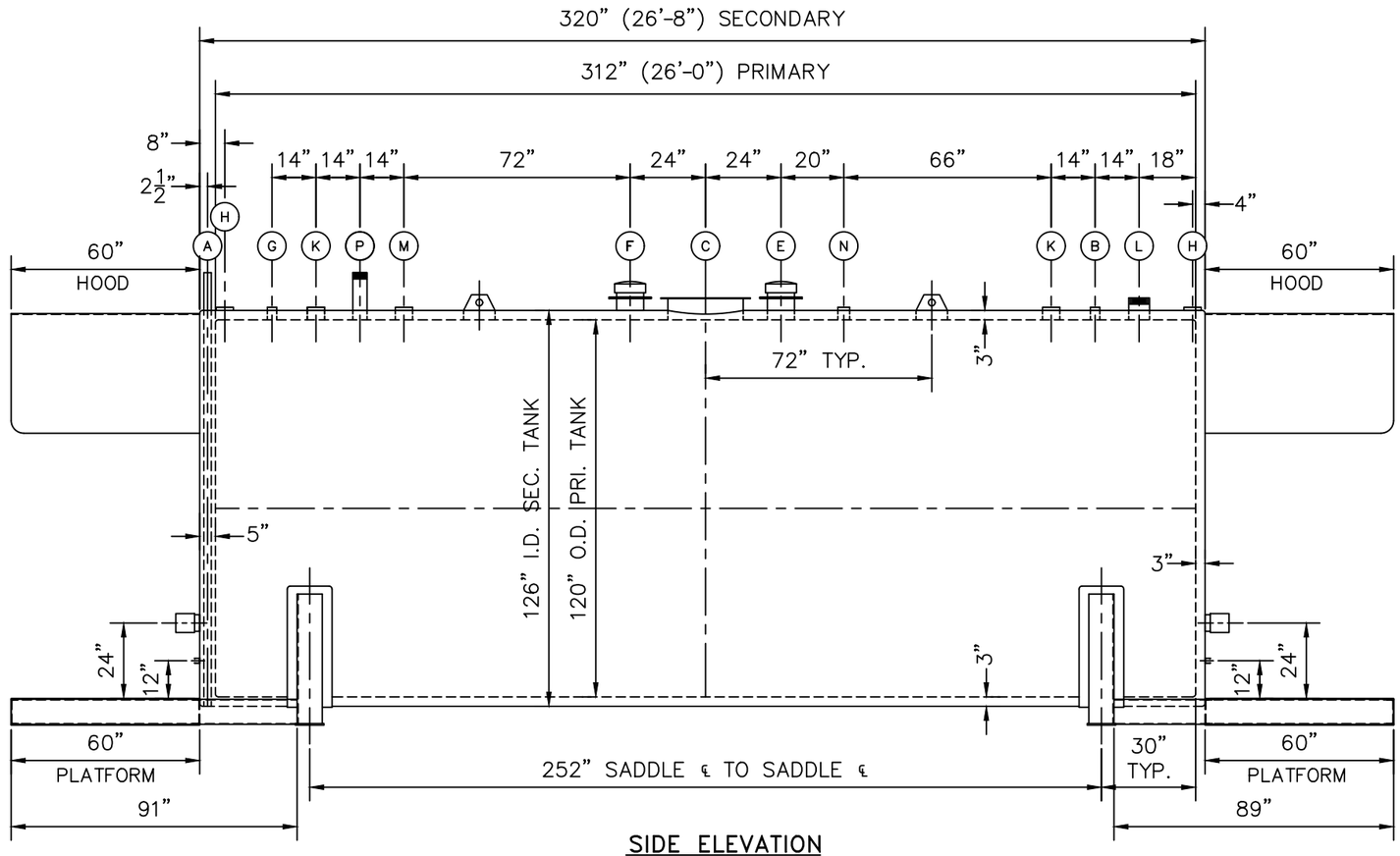
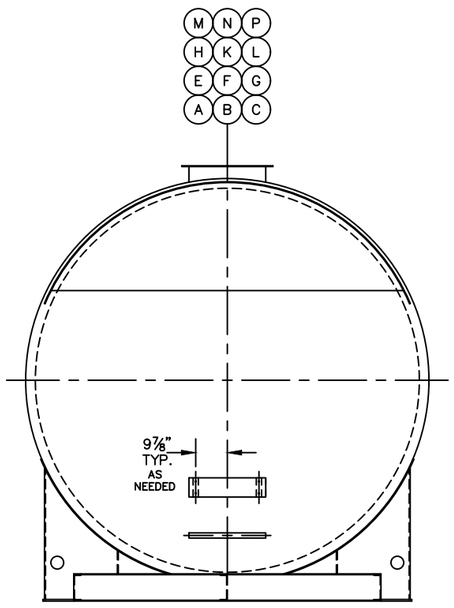
5,000 GALLON FIREGUARD TANK

DWN. BY	JS	DATE 6/5/2018	SCALE: NONE	
CHK. BY	JC	JOB NO. –	DWG. NO. –	0
APR. BY	–	P.O. NO. –	SHT. NO. 5 OF 5	



SIDE ELEVATION



BOTH END VIEWS

GENERAL NOTES

FABRICATION PER: UL-142 & UL-2085
LABEL REQUIRED ☒YES ☐NO UL
SHOP TEST: PER UL-142
3-5 PSI AIR WITH SOAP SUDS
INSPECTION BY: MODERN WELDING Q.C.
MATERIAL SHELL: PER UL C.S
FLANGES: A105
SADDLES: A36
INT. APPURTENANCES: C.S.
EXT. APPURTENANCES: C.S.
BOLTS: GR. 5 (ZINC PLATED)
NUTS: GR. 5 (ZINC PLATED)
GASKETS: FULL FACED UL GASKETS
SURFACE PREP EXT.: SSPC-SP6 INT.: NONE
PAINT:
EXT.: SW 4036 MILL IVORY
PER MANUFACTURES RECOMMENDATIONS
INT.: NONE
VENTING CAPACITY (CFH) PRI.: 438,200
VENTING CAPACITY (CFH) SEC.: 458,300
EST. WT. EMPTY: 35,000 LBS.

NOTE:
EMERGENCY VENTING LABELS FOR PRIMARY TANK & ANNULAR SPACE ARE REQ'D. LABEL SHALL BE ATTACHED NEXT TO OR BETWEEN BOTH EMERGENCY VENTS.

ALL FILLET WELDS TO BE 1/4" MIN. UNLESS OTHERWISE NOTED.

ALL NOZZLE AND MANWAY BOLT HOLES TO STRADDLE NORMAL CENTER LINES OR THEIR PARALLEL UNLESS OTHERWISE NOTED.

*EMERGENCY VENTS TO BE SUPPLIED BY MODERN WELDING.

	MARK	REQ'D.	SIZE	ITEM	RATING	TYPE	SERVICE
	P	1	4"	PIPE NIP	SCH 40	TOE	ELECTRONIC LEVEL
	N	1	3"	COUPLING	150#	FG	VENT
	M	1	4"	COUPLING	150#	FG	SPARE
	L	1	6"	PIPE NIP	SCH 40	TOE	FILL
	K	1	4"	COUPLING	150#	FG	PUMP
	H	2	4"	TANK FLG.	-	CRVD	CONCRETE FILL
	G	1	2"	COUPLING	150#	FG	RETURN
*	F	1	8"	FLANGE ADAPTER	150#	MB	SEC. EMERGENCY VENT
*	E	1	8"	FLANGE ADAPTER	150#	MB	PRI. EMERGENCY VENT
	C	1	24"	PRESSED STEEL	-	STD	MANWAY w/COVER
	B	1	2"	COUPLING	150#	FG	GAUGE
	A	1	2"	PIPE	SCH.40	T.O.E	MONITOR

SCHEDULE OF OPENINGS

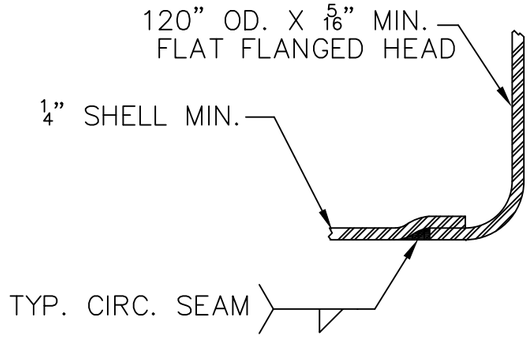
BY		DATE	NO
JS/JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
AP	REVISION	DATE	NO

NO. REQ'D ONE(1) ITEM NO.

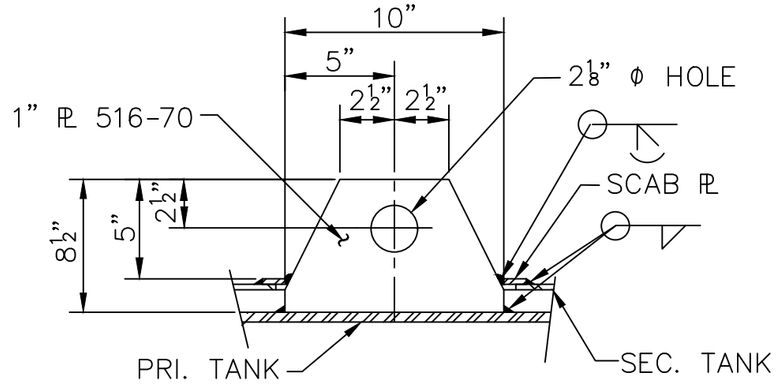
MODERN WELDING CO. of OHIO INC.
P.O. Box 4430
One Modern Way
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
15,000 GALLON FIREGUARD TANK

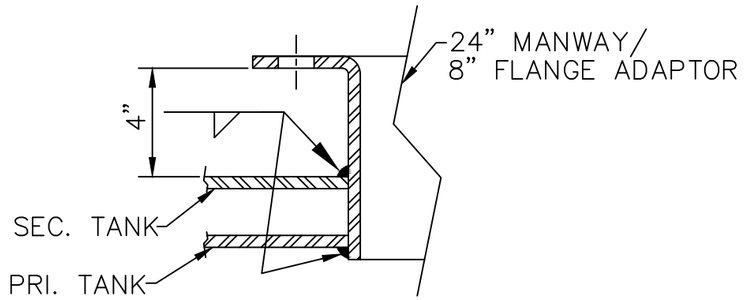
DWN. BY	JS	DATE 6/5/2018	SCALE: NONE
CHK. BY	JC	JOB NO. -	DWG. NO. — 0
APR. BY	-	P.O. NO. -	SHT. NO. 1 OF 5



DETAIL @ PRI. CIRC. SEAM

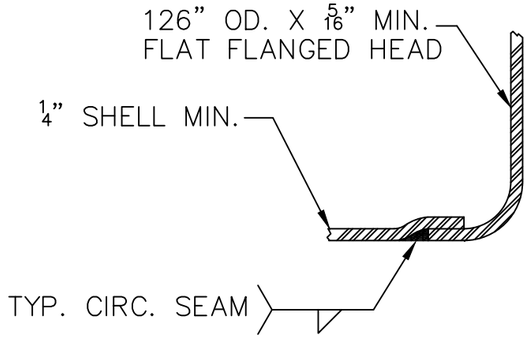


DETAIL @ LIFTING LUG
(4) REQ'D.

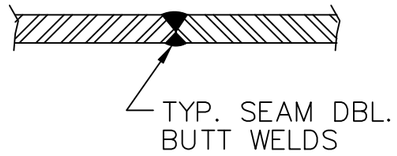


DETAIL @ MANWAY/PRI. EMER. VENT (C)(E)

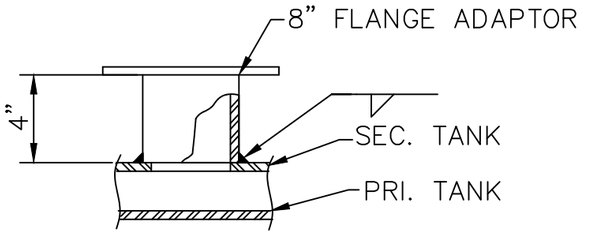
NOTE: CUT PRI. VENT TO CONTOUR OF PRI. TANK



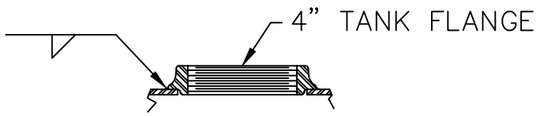
DETAIL @ SEC. CIRC. SEAM



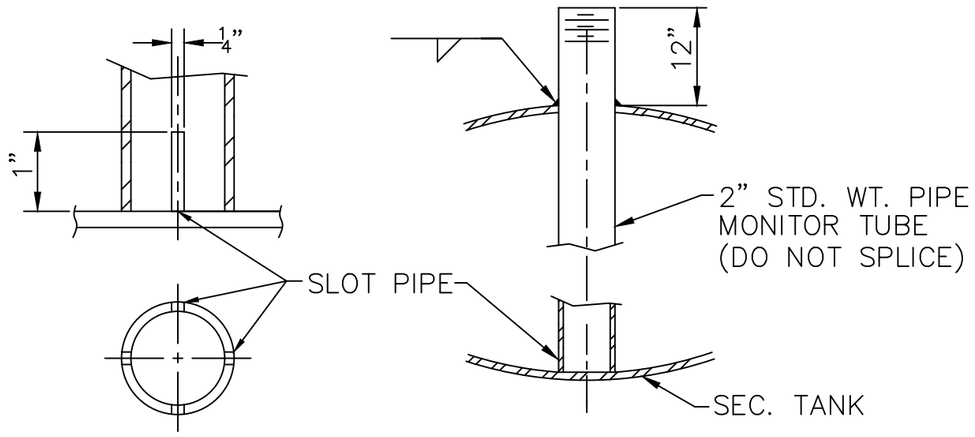
TYP. LONG'T. SEAM



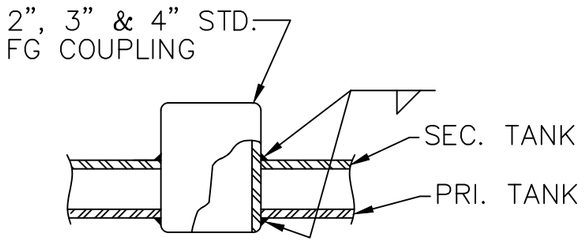
DETAIL @ SEC. EMER. VENT (F)



DETAIL @ TANK FLANGE (H)



DETAIL @ MONITOR PIPE (A)



DETAIL @ COUPLINGS (B)(G)(K)(M)(N)

JS/JC	ORIGINAL ISSUE FOR APPROVAL	6/5 2018	0
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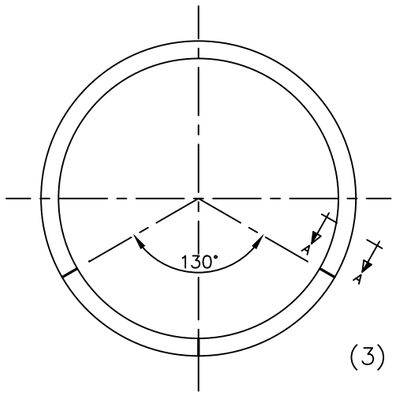
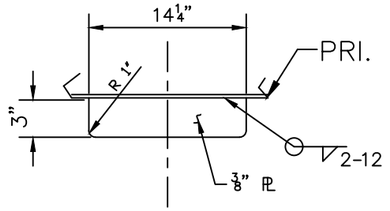
P.O. Box 4430
One Modern Way
modern
Newark, Ohio 43055
(740)344-9425

JOHN W. KENNEDY CO.
15,000 GALLON FIREGUARD TANK

DWN. BY	JS	DATE 6/5/2018	SCALE: NONE
CHK. BY	JC	JOB NO. -	DWG. NO. - 0
APR. BY	-	P.O. NO. -	SHT. NO. 2 OF 5

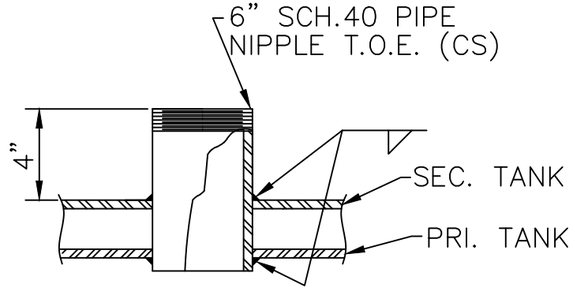




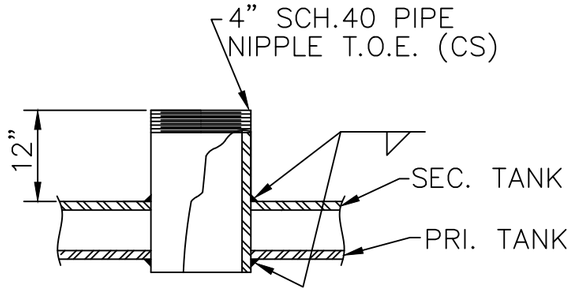
SECTION A–A

(3) REQ'D. CENTERED OVER EACH SADDLE

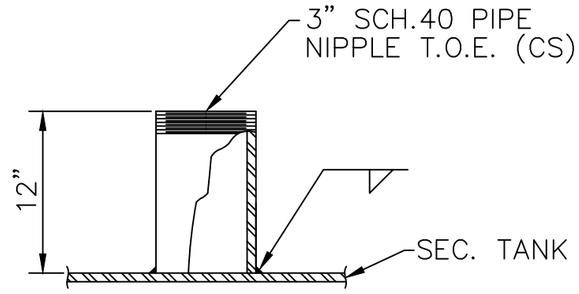
LAYOUT & SPACER PLATES



DETAIL @ FILL (L)

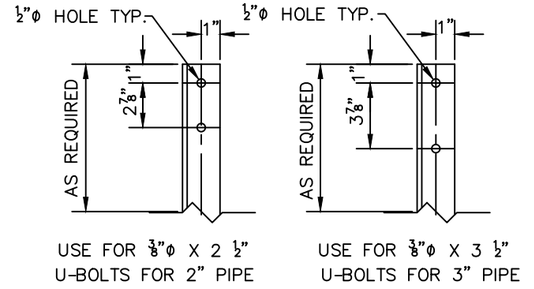


DETAIL @ PIPE NIPPLE (P)



DETAIL @ CABLE SUPPORT

(2) REQ'D

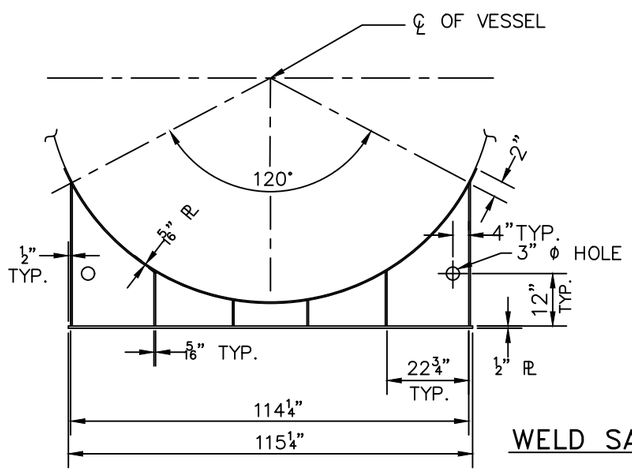


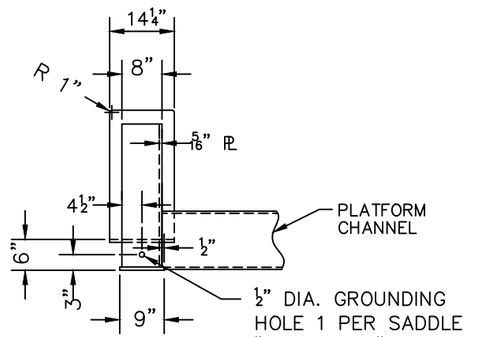
USE FOR ⅜"ϕ X 2 ½" U-BOLTS FOR 2" PIPE

USE FOR ⅜"ϕ X 3 ½" U-BOLTS FOR 3" PIPE

DETAIL @ PIPE SUPPORT

2"x2"x¼" ANGLE





WELD SADDLES TO TANK

NOTE: ALL FILLET WELDS ON SADDLES ARE TO BE 3/16" MIN.

CUSTOMER NOTE: GROUNDING LUG IS TO BE BOLTED AT THIS HOLE

DETAIL @ SADDLE

(2) REQ'D

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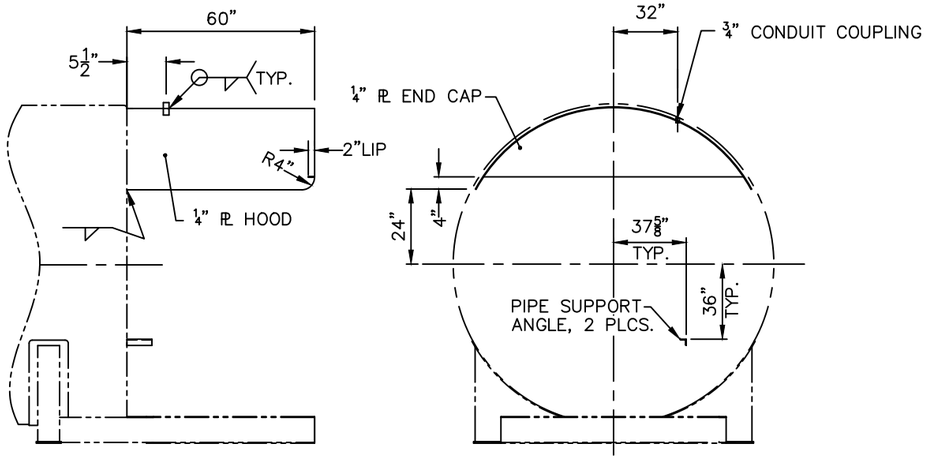
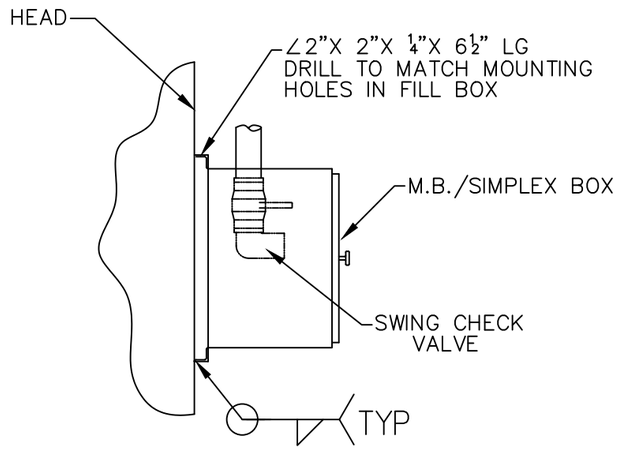
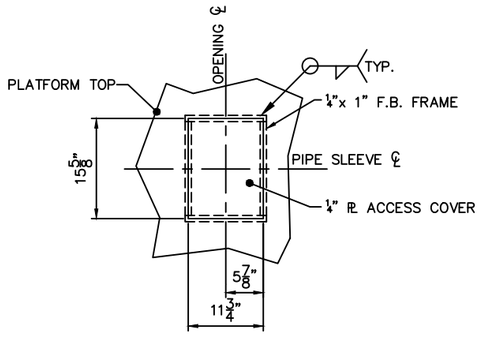
APR. BY	–	P.O. NO. –	SHT. NO. 3 OF 5	



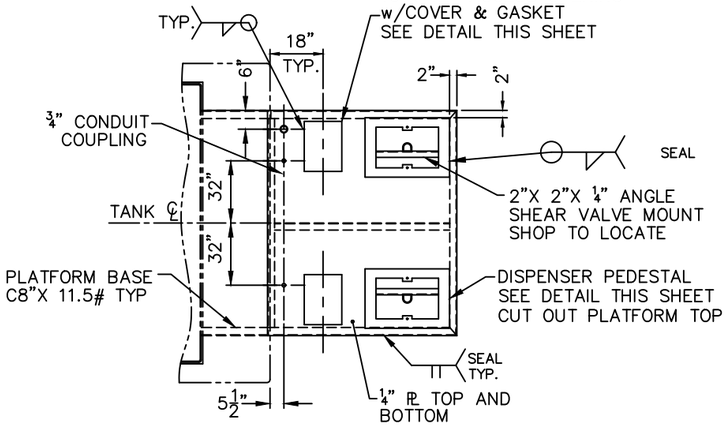
DETAIL @ RAIN HOOD
(2) REQ'D.

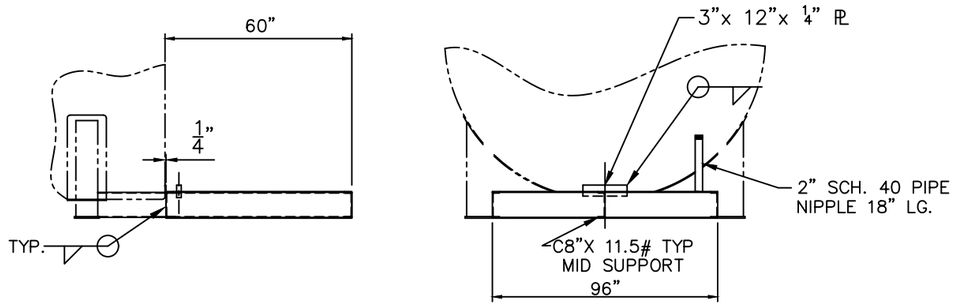


DETAIL @ FILL BOX MOUNTING

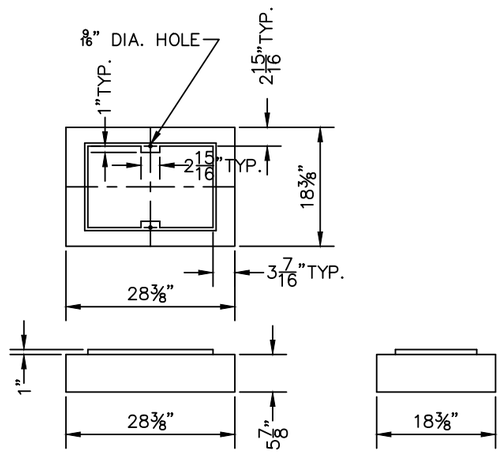


DETAIL @ ACCESS OPENING
(4) REQ'D.





DETAIL @ CONTAINMENT PLATFORM
(2) REQ'D.



DETAIL @ PUMP PEDESTAL
(4) REQ'D.
7 GA. MATERIAL

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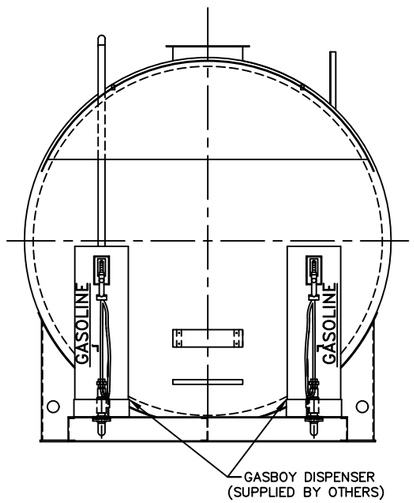
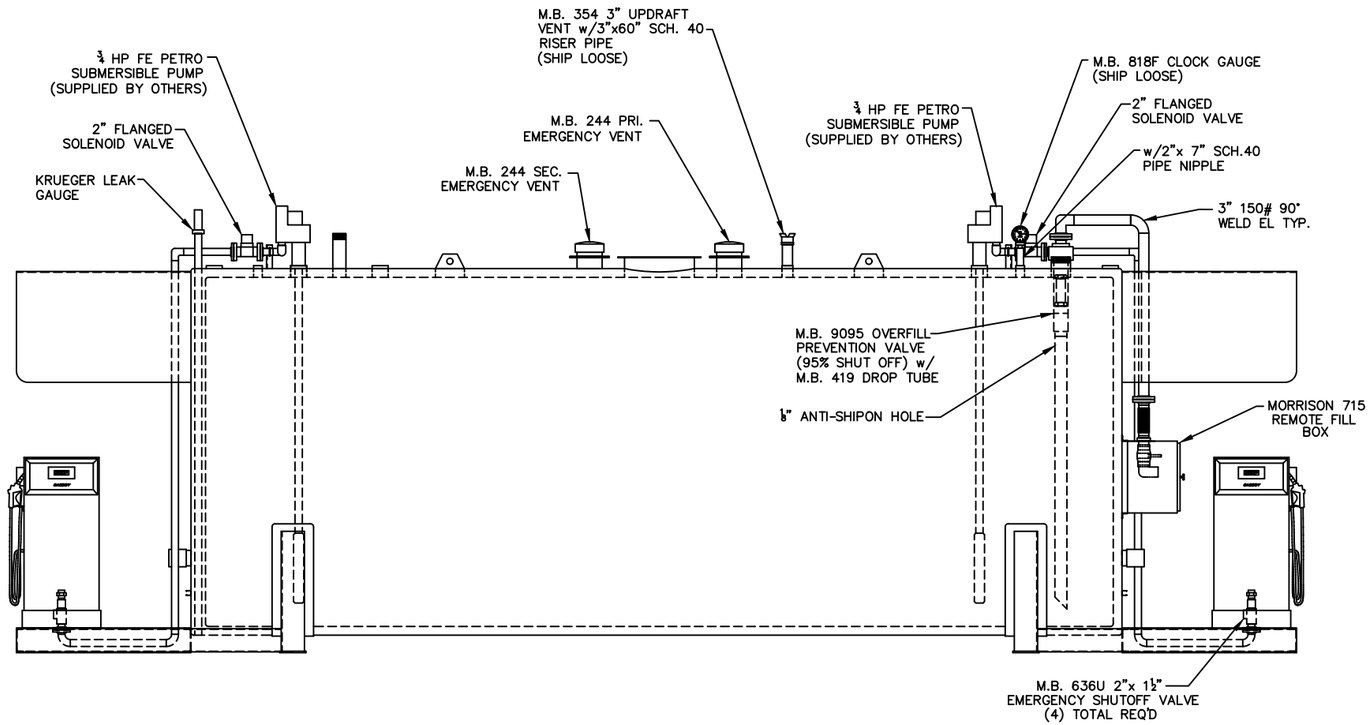
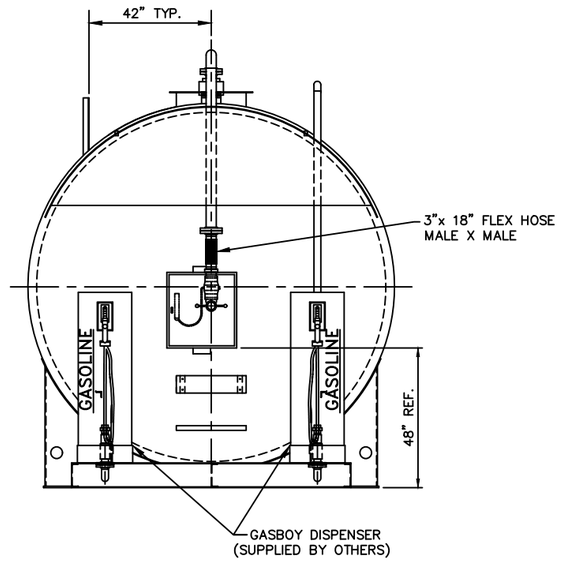
APR. BY	–	P.O. NO. –	SHT. NO. 4 OF 5



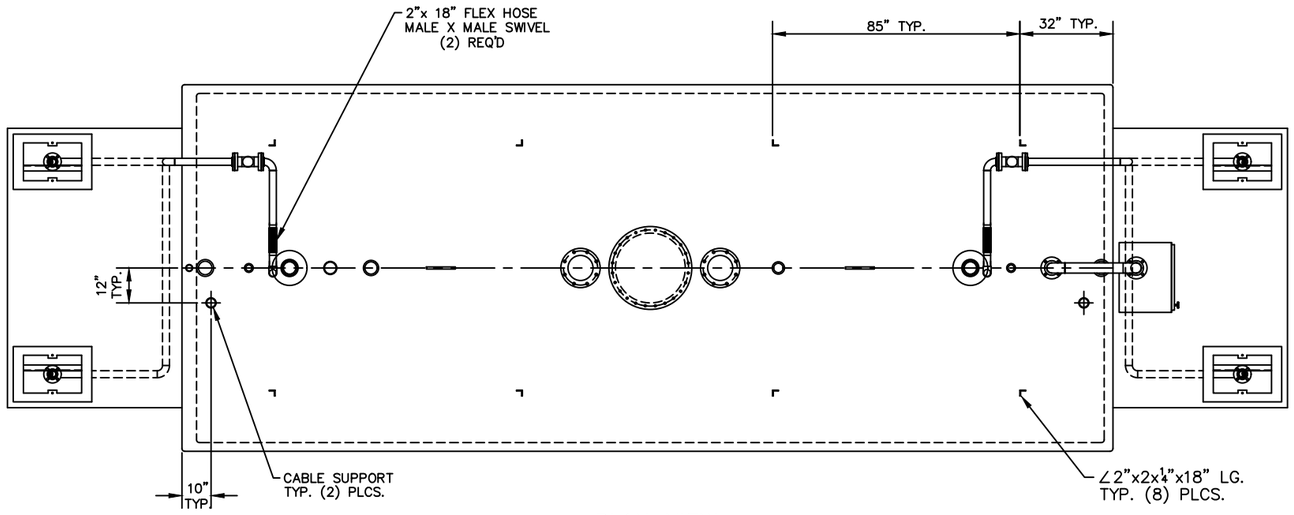
END VIEW



SIDE ELEVATION



END VIEW



PLAN VIEW

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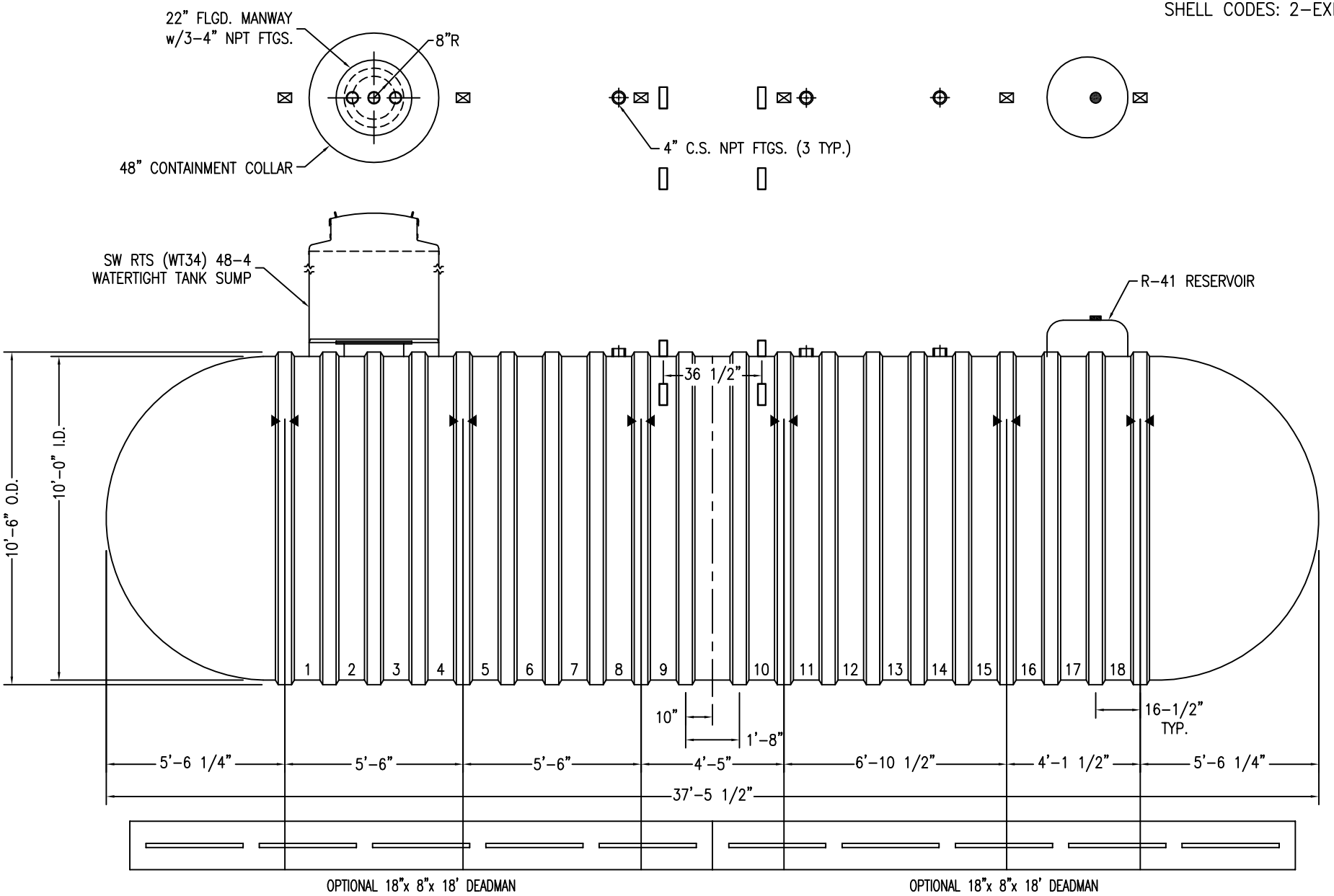
APR. BY	-	P.O. NO. -	SHT. NO. 5 OF 5	

SHELL CODES: 2-EXD10SD



NOTES:

- ⊠ HOLD DOWN STRAP CLIP
- ▶◀ HOLD DOWN STRAP LOCATION
- ▯ TYPE "13" LIFT LUG – SD
- ▮ TYPE "13" LIFT LUG – HD

MODEL DWT 6 (10) 20000		DATE: 06/18/18
JOHN W. KENNEDY		DRAWN BY: R.OXNER
CONTAINMENT SOLUTIONS®	CAPACITY: 19,951	REVISED:
	WEIGHT: DRY/WET 9750/13350	DWG NUMBER: 13974-000