City of Rockville
Rockville, Maryland

INVITATION FOR BID #11-23
CONSTRUCTION OF A BULK SODIUM HYPOCHLORITE SYSTEM

Bids Due by 2:00 P.M., Tuesday, August 8, 2023

ISSUED BY:

Procurement Division
City of Rockville, City Hall
111 Maryland Avenue
Rockville, Maryland 20850
Phone: (240) 314-8430
Fax: (240) 314-8439

A 5% Bid Bond is required for this Invitation for Bid

Any individual with a disability who would like to receive the information in this publication in another form may contact the ADA Coordinator at 240-314-8100, TDD 240-314-8137

MFD-V Outreach Program
It is the intent of the City of Rockville to increase opportunities for minority, female, disabled, or veteran (MFD-V) owned businesses to compete effectively at supplying goods, equipment, and services to the City, within the constraints of statutory purchasing requirements, departmental needs, availability, and sound economical considerations. Suggested changes and MFD-V enhancements to this solicitation's requirements for possible consideration and/or inclusion in future solicitations are encouraged. Any questions regarding MFD-V outreach or questions/concerns regarding the City's bidding process should be addressed to Pat Ryan, pryan@rockvillemd.gov or 240-314-8434.

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Statement of "No Bid Submittal"

If you do not intend to submit on this requirement, please complete and return this form prior to date shown for receipt of bids to the buyer listed in this IFB by **email only to tellison@rockvillemd.gov**.

I/WE HAVE DECLINED TO BID ON **IFB # 11-23**, titled **CONSTRUCTION OF A BULK SODIUM HYPOCHLORITE SYSTEM** for the following reason(s): [Please place a check mark (✓) next to the reason(s) as applicable]

(✓)	Reason
	Proposal requirements too "restrictive".
	Insufficient time to respond to the Invitation for Bids.
	We do not offer this service.
	Our schedule would not permit us to perform.
	Unable to meet requirements.
	Unable to meet insurance or bond requirements.
	Scope of Services unclear (please explain below).
	Other (please specify below).

REMARKS:

_____

_____

_____

Are you a Minority, Female, Disabled or Veteran-Owned (MFD-V) business? _____ Yes _____ No

Company Name: _____

Mailing Address: _____

Telephone Number: _____ Email Address: _____

_____ _____
Authorized Signatory Printed Name

_____ _____
Title Date

CITY OF ROCKVILLE

ROCKVILLE, MARYLAND

INVITATION FOR BID 11-23
CONSTRUCTION OF A BULK
SODIUM HYPOCHLORITE SYSTEM

SECURED BIDS will be received electronically via a City-designated bid receipt software solution until **2:00 P.M., Tuesday, August 8, 2023.** The bidder assumes full responsibility for the timely delivery of a bid via the designated solution. Bids delivered in any other fashion will not be considered. Properly submitted bids will be opened in a virtual environment after the time set for receipt of bids and will be read aloud via a City telepresence software solution at the phone number and/or web address provided by the City and contained within this solicitation.

Submission of a bid electronically is consent by the bidder to conduct any or all elements of the procurement by electronic means, in accordance with the terms of this invitation for bid.

Bids presented after the bid receiving deadline will not be received for any reason. The official time clock for receiving bids will be that of the City's third-party software solution provider's computer server system.

ATTENTION: BIDDERS ARE HEREBY NOTIFIED THAT THE CITY'S THIRD-PARTY SOFTWARE SOLUTION PROVIDER'S COMPUTER SERVER TIME MAY DIFFER FROM THAT OF OTHER ELECTRONIC DEVICES, COMPUTER SOFTWARE AND COMPUTER HARDWARE THAT MAY BE USED TO ELECTRONICALLY SUBMIT THE BID. BIDDERS ARE RESPONSIBLE FOR ALLOWING ADEQUATE TIME TO SUCCESSFULLY DELIVER THE BID TO THE REQUIRED ELECTRONIC LOCATION BY THE REQUIRED TIME.

PRE-BID CONFERENCE

A virtual, telepresence pre-bid meeting will be held on **Thursday, July 13, 2023, at 3:00 PM.** Bidders must register below in order to attend the meeting. This meeting is not mandatory; however, bidders are strongly encouraged to attend.

Register For Virtual Pre-Bid Meeting Here: Register

SITE VISITS/WALK-THROUGHS

Individual, ninety (90) minute, City staff guided site visits/walk-throughs will be made available for each interested firm during the week of **July 17 - 21, 2023**, where no more than five (5) members from a firm may attend their firm's scheduled site visit/walk-through. Participation in a site visit/walk-through by a firm is NOT mandatory. Requests to schedule a site visit/walk-through shall be directed to Matthew Brew, Principal Civil Engineer via email only at mbrew@rockvillemd.gov no later than 10:00 AM, **Friday, July 14, 2023**. When submitting a request include the following information in the email subject line:

IFB # 11-23 Site Visit/Walk-Through.

The City will be blocking out four (4), ninety (90) minute time slots per day for a total of 20 visits during the week of **July 17 - 21, 2023** at 8:00 AM, 10:00 AM, 1:00 PM and 3:00 PM. Prospective bidders are to request a day and time slot in the e-mail request to Matthew Brew, Principal Civil Engineer via email only at mbrew@rockvillemd.gov.

Depending on the pre-bid meeting date/time, coordination with WTP electrical contractor may be required. The Water Treatment Plant is an active construction site. As such, all visitors must wear hard hats, reflective vests and steel toed shoes. Access may be allowed within the main building depending upon the ongoing construction project.

DEADLINE FOR QUESTIONS

Questions pertaining to this bid may be directed to TJ Ellison, Principal Buyer via the City's Collaboration Portal only at https://contracts.rockvillemd.gov/gateway/Default.aspx no later than **Tuesday, July 25, 2023, AT 02:00 PM**. Oral answers to questions relative to interpretation of specification or the bid process will not be binding on the City.

PROJECT DESCRIPTION

The project is for replacing the existing chlorine gas system with a bulk sodium hypochlorite system at Rockville's Water Treatment Plant; and all other work as shown on the contract documents and where specified herein. The water treatment plant is located in Montgomery County on Sandy Landing Road in Potomac, Maryland. The plant was originally built in 1958 with a 4 million gallons per day (MGD) capacity, then upgraded to its current capacity of 8 MGD in 1968. The project consists of the furnishing of all labor, materials, equipment, tools and services for the upgrades and other associated work as specified in the contract documents.

The Construction of a Bulk Sodium Hypochlorite System project scope of work includes but is not limited to the following:

- Demolition of the existing gas chlorine room and systems.
- Alterations to Chlorine Room exterior walls and interior floor as well as the addition of a containment system.
- Removal and replacement of chlorine feed system, HVAC systems; emergency eye wash/shower systems and fire protection systems.
- Installation of chlorine storage and day tanks, pump, piping, and control systems; and all other appurtenances.
- Works involves structural, electrical, mechanical, plumbing, fire protection and instrumentation systems.
- Demolition of the Chlorine Gas crane, monorail, and support structures
- Construct concrete overlay and other improvements around the Chlorine Gas Storage Platform.
- Remove and dispose of Silo #3, including all appurtenances within the Chemical Building and to include concrete floor improvements. (Bid Alternate #1).
- Maintain a temporary chlorine system for the duration of construction as per the contract documents.
- Obtain trade permits and coordinate inspections with Montgomery County Department of Permitting Services (DPS).

BID SECURTIY

Bids must be accompanied by an electronic copy of the Bid security made payable to the Mayor and Council of Rockville in an amount of five percent (5%) of Bidder's Total Bid Price and in the form of a Bid Bond (AIA Bid bond form is acceptable) or a certified check, where the original security instrument must be mailed to the City of Rockville, Procurement Division, 111 Maryland Avenue, Rockville, Maryland 20850, referencing the solicitation number. The City reserves the right to disqualify any bid, in any instance, where the City cannot locate the mailed, original security instrument. The City shall not be liable for any certified checks it cannot locate, or in any instance where a certified check is cashed by any individual not employed by the City of Rockville.

AGREEMENT/PERFORMANCE & PAYMENT BONDS

The successful contractor shall be required to complete and electronically return a copy of the City's Standard Form of Agreement along with Performance and Payment Bonds in the amount of 100% of the Contract award within fifteen days after the date of issuance, where two (2) sets of the original agreement and original bonds must be mailed to the City of Rockville, Procurement Division, 111 Maryland Avenue, Rockville, Maryland 20850. No other form of performance or payment security will be permitted. Failure by the contractor to provide the electronic versions and original versions of the agreement or bonds, as required, shall be just cause for annulment of the award and the forfeiture of the Bid Guarantee which shall become the property of the City, not as a penalty but in liquidation of damages sustained. Any instance where the City cannot locate the mailed versions of the agreement or bonds shall be just cause for annulment of the award and the forfeiture of the Bid Guarantee which shall become the property of the City, not as a penalty but in liquidation of damages sustained.

INSURANCE

The successful contractor shall be required to electronically furnish a certificate of insurance to include endorsements for additional insured and waiver of subrogation requirements within fifteen days after the date of request by the City. Failure by the contractor to provide insurance shall be just cause for annulment of the award and the forfeiture of the Bid Guarantee which shall become the property of the City, not as a penalty but in liquidation of damages sustained.

SUBMISSION

All bid forms and documents must be electronically filled out, signed, and submitted via one combined pdf document using the City's Collaboration Portal **only** at:

https://contracts.rockvillemd.gov/gateway/Default.aspx

At a minimum the file name of the pdf document must contain the Bid Number, Bidders Name and Bid Due Date.

A virtual, telepresence bid opening will be held a few minutes after the bid submittal due date and time. Individuals interested in attending the virtual bid opening must register below:

Register for Virtual Bid Opening Here: **Registration Link**

SUBMITTALS

The following information must be submitted with the bid, **where failure to submit requested items with the bid may result in rejection of the bid:**

- Bid Proposal Form;

- A certified check or bid bond must be in the amount of five percent (5%) of the total bid amount, made payable to the Mayor and Council of Rockville as in General Conditions and Inspections to Bidders, #24; and
- If the bidder intends to subcontract any or part of the work, then the bidder must identify and include references for each qualified subcontractor, together with a description of the proposed subcontract work. This evidence shall be submitted with the bid. A minimum of three references shall be provided; additional project references may be required to meet all the requirements.

UNBALANCED BID

- An unbalanced bid is a bid with line items or unit prices with an extreme variation from the City's estimate, or where obvious unbalancing of unit prices has occurred.
- If the Procurement division determines that the bid appears to be unbalanced, the Procurement division will require that the Bidder submit documentation justifying the bid price(s) proposed.
- If the Bidder's justification does not satisfy the Procurement division, and, if the award of the contract to the Bidder would result in an advantage to the Bidder with a corresponding disadvantage to the City, or, if the competitive bidding process is jeopardized, then Procurement will reject the bid proposal as non-responsive in order to protect the public interest.

BID AWARD

Award will be made to the lowest responsive and responsible bidder(s) complying with all provisions of the Invitation for Bid provided the price is reasonable and in the best interest of the City to accept. The City reserves the right not to award or use the bid alternative (Silo Removal) when determining the low bid value. In the event the City decides to award the bid alternative, then the alternative bid item will be used in determining the low bid value.

BIDDER QUALIFICATIONS

At a minimum, Bidders must provide written evidence (through references) of five (5) years prior experience with the scope of work as detailed in the specifications.

If the bidder intends to subcontract any or part of the work, then the bidder must identify and include references for each qualified subcontractor, together with a description of the proposed subcontract work. This evidence shall be submitted with the bid, or the City, at its discretion, may determine the bid to be unresponsive. A minimum of three references shall be provided; additional project references may be required to meet all the requirements.

The City shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform the work and reserves the right to request additional information. The right is reserved to reject any bid where an investigation of the evidence or information submitted by such Bidder does not satisfy the City that the Bidder is qualified to properly carry out the terms of the Bid Document. Alternatively, the City may request a low Bidder to replace and resubmit qualifications for portions of work being performed by a subcontractor without alteration to the cost proposal.

ADDENDUM

Oral answers to questions relative to interpretation of specifications or the proposal process will not be binding on the City.

To ensure fair consideration for all offerors, any interpretation made to prospective offerors will be expressed in the form of an addendum to the specifications, if such information is deemed necessary for the preparation of

proposals or if the lack of such information would be detrimental to the uninformed offeror. Such addendums, if issued, will be posted at the address listed below:

https://www.rockvillemd.gov/bids.aspx

Please note, that it is the respondent's responsibility to check this site frequently for Addendums, which may impact pricing, this documents requirements, terms and/or conditions. Failure to sign and return an Addendum with your response may result in disqualification of proposal.

NOTICE TO BIDDERS

Companies not incorporated in the State of Maryland must be in compliance with the State of Maryland Code of Regulations Title 21, State Procurement Regulations in order to enter into a contract with the City. "Pursuant to 7-201 et seq. of the Corporations and Associations, Article of the Annotated Code of Maryland corporations not incorporated in the State, shall be registered with the Department of Assessments and Taxation, 301 West Preston Street, Baltimore, Maryland 21201 before doing any interstate or foreign business in this state. Before doing any intrastate business in this state, a foreign corporation shall qualify with the Department of Assessments and Taxation."

US TREASURY IDENTIFICATION NUMBER

Bidders must supply with their bids their U.S. Treasury Department Employers' Identification Number as such number is shown on their Employer's quarterly Federal Tax Return (U.S. Treasury Department Form No. 941). This number shall be inserted on the Bid Sheet in the space provided.

QUALIFICATION TO CONTRACT WITH PUBLIC BODY

Bidders must be qualified to bid in the State in accordance with Section 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland which ordains that any person convicted of bribery (upon acts committed after July 1, 1997) in furtherance of obtaining a contract from the state or any subdivision of the State of Maryland shall be disqualified from entering into a contract with the City.

DISABILITY INFORMATION

ANY INDIVIDUALS WITH DISABILITIES WHO WOULD LIKE TO RECEIVE THE INFORMATION IN THIS PUBLICATION IN ANOTHER FORM MAY CONTACT THE ADA COORDINATOR AT 240-314-8100 TDD 240-314-8137

PROJECT PLANS

Proposers must complete the Application for Requesting Engineering Records/Information Form and email it to pw@rockvillemd.gov. Include a photocopy of current driver's license with the application.

Once approved, the City of Rockville project manager will provide secure access to the project plans.

APPLICATION FOR REQUESTING ENGINEERING RECORDS/INFORMATION

ALL individuals requesting City of Rockville's Engineering Records/Information must complete this application. Due to COVID-19, plans will be sent electronically to the email address listed in contact information.

PLEASE FILL IN ALL BLANKS UNLESS OTHERWISE NOTED. THIS APPLICATION, ALONG WITH A COPY OF A VALID, CURRENT DRIVER'S LICENSE, MUST BE SUBMITTED WITH THIS APPLICATION. SEND VIA EMAIL TO PW@ROCKVILLEMD.GOV.

APPLICANT NAME			**DRIVER'S LICENSE**	
Last Name	First Name	MI	State	Number

COMPANY APPLICANT REPRESENTS (List Legal and Trade Name, if applicable)

CONTACT INFORMATION

Home Address			Company Address (Where information will be located)		
Street (No P.O. Boxes allowed)			Street (No P.O. Boxes allowed)		
City	State	Postal Code	City	State	Postal Code
Telephone	Fax		Telephone	Fax	
E-Mail			E-Mail`		

REFERENCE WHO CAN CONFIRM BUSINESS USE

Applicant's immediate supervisor or company official who can confirm length of employment, applicant's position with firm, and related business with Rockville (if appropriate, applicant must list City Staff contact on project and project #).

Company Official Contact	**Authorized Rockville Contact**
Name Signature	Name, Title, Phone #, Project #
Telephone	
E-Mail Web address	

Please Note: Refer to Fee Schedule for list of prices for records/information requested.

To complete the process, the applicant must submit this form and then sign it via Docusign upon request by the City of Rockville.

By signing this application, I certify that this application is complete and accurate to the best of my knowledge and that I have not made any attempt to conceal information. I understand that falsification could be cause for refusal. I also agree to the following terms:

- City of Rockville reserves the right to require occasional renewal of this application. If the application is not renewed when required, documents will not be released until application renewal is completed.
- My company and I will abide by the terms of non-disclosure listed below. Failure to do so may result in permanent revocation of my company's and my right to access City of Rockville records/information. In such case, City of Rockville also reserves the right to demand immediate delivery or return of all City of Rockville records/information, documents, and files.

Non-Disclosure Agreement

As a condition to furnishing the applicant with City of Rockville's engineering records/information, the Applicant and the Applicant's Company agree to the following:

- The Applicant or the Applicant's Company shall not use the records/information provided by City of Rockville for the purposes other than stated on the application.

- The records/information will be treated as property of the City of Rockville, and shall not, without the City of Rockville's prior written consent, be disclosed in any manner, in whole or in part, to anyone outside of the Applicant's Company or within the Applicant's Company except for purposes involving legitimate business needs for such records/information.

Applicant's Signature	**Date**

CITY OF ROCKVILLE
MARYLAND
GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS
CONSTRUCTION 3/2022

1. **TERMS AND CONDITIONS** The terms and conditions of this document govern in event of conflict with any terms of the bidder's proposal,and are not subject to change by reasons of written or verbal statement by the contractor unless accepted in writing. Words and abbreviations which have well known technical or trade meanings are used in accordance with such meanings.

2. **PRE-BID MEETING** A virtual, telepresence pre-bid meeting may be held for the purpose of describing the project and for answering any questions prospective bidders may have. If applicable, time and date will be shown on the bid announcement page.

3. **SUBMISSION OF BID** All bids are to be submitted electronically, in a pdf format file, via a City designated bid receipt software solution. File name of the pdf document must contain the Bid Number, Bidders Name and Bid Due Date. The following forms must be submitted:

    - Bid proposal page(s) in duplicate
    - Non-collusion/non-conviction affidavit
    - Bid Bond
    - Reference sheet
    - Other forms as required in the bid document.

    The bid proposal form must be filled out and submitted electronically. Conditional bids and bids containing escalator clauses will not be accepted. All bids must be regular in every respect and no interlineation, exclusions, or special conditions shall be made or included. Bids must contain an electronic or scanned signature, in the space provided, of an individual authorized to bind the bidder.

4. **LATE BIDS** It is the bidder's responsibility to assure delivery of the bid at the proper time via the designated electronic, software solution. Bids delivered in any other fashion will not be considered. All bids will be publicly opened in a virtual environment after the time set for receipt of bids and read aloud via a City telepresence software solution. Bidders may attend bid openings at the phone number and/or web address provided by the City.

5. **ADDENDUM** In the event that any addenda to this solicitation are issued, all solicitation terms and conditions will retain in effect unless they are specifically changed in the addendum. It is the responsibility of the bidder to make inquiry as to addenda issued. Oral answers to questions relative to interpretation of specifications or the proposal process will not be binding on the City.

    Such addendums, if issued, will posted via the city's designated electronic, software solution

    Please note, that it is the bidder's responsibility to check this site frequently for Addendums, which may impact pricing, this document's requirements, terms and/or conditions. Failure to acknowledge an addendum on the bid proposal form or to sign and return an Addendum with your response may result in disqualification of proposal.

6. **BID OPENING** All bids received in response to an Invitation for Bid will be opened at the date, time and place specified and publicly read via a City telepresence software solution. A tabulation of bids received are posted using the City's designated electronic software solution.

7. **ACCEPTANCE OF BIDS** The City will accept or reject any or all bids or any or all items within 180 days after the date of bid opening. Bids may not be withdrawn during that period.

8. **BID WITHDRAWAL** Bids may be electronically withdrawn (deleted) or modified by deleting the initial file uploaded and replacing it with a modified file using the City's electronic, software solution before the time specified for bid opening. Requests received after bid opening will not be considered.

9. **BID AWARD** Award will be made to lowest responsive and responsible bidder complying with all provisions of the Invitation for Bid, provided the price is reasonable and in the best interest of the City to accept. The City reserves the right to award by individual commodities/services, group, all or none or any combination thereof. When a group is specified, all items in the group must be bid.

    In determining the responsibility of a bidder, the following criteria will be considered:

    a. The ability, capacity and skill of the bidder to perform the contract or provide the services required;

    b. Whether the bidder can perform the contract or provide the service promptly, or within the time specified, without delay or interference;

    c. The character, integrity, reliability, reputation, judgment, experience and efficiency of the bidder;

    d. The quality of performance on previous contracts or services;

    e. The previous and existing compliance by the bidder with laws and ordinance relating to the contract or service;

    f. The sufficiency of the financial resources and ability of the bidder to perform the contract or provide the service;

g. The quality, availability and adaptability of the goods or services to the particular use required;

h. The ability of the bidder to provide future maintenance and service for the use of the subject of the contract;

i. Whether the bidder is in arrears to the City or a debt or contract or is in default on a surety to the City;

j. Such other information as may be secured by the City having a bearing on the decision to award the contract.

10. ELECTRONIC PAYMENT OPTION

The Vendor ACH Payment Program of the City allows payments to be deposited directly to a designated financial institution account. Funds will be deposited into the account of your choice automatically and on time. All transactions are conducted in a secure environment. The program is totally free as part of the Finance Department's efforts to improve customer services.

11. **SENSITIVE DOCUMENTS**

All project participants needing either electronic or hardcopy documents dealing with critical facilities or sensitive information will be required to make application with, and receive approval from the City prior to receiving this information. Permission to receive said documents (herein referred to as "sensitive") will pertain only to the individual approved. Sensitive documents (either electronic or hardcopy documents dealing with critical facilities or sensitive information) received from the City must be handled consistent with the terms of non-disclosure required for application. Contractor is responsible to restrict use of sensitive documents to project participants only and shall take appropriate measure to prevent distribution of sensitive document to anyone inside or outside of the Contractor's company except Contractor's project participants. After completion of the project, all sensitive documents remaining in the Contractor's possession shall continue to be governed under the terms of non-disclosure and must continue to be stored in a secure manner. After such records are no longer needed for record purposes, the records shall be destroyed or returned to the City.

Where services require the Contractor to access the City's electronic information resources and/or its electronic data assets, the Contractor shall adhere to all requirements, terms and conditions of the City's Contractor/Vendor On-Site and Remote Access Confidentiality Agreement, which can be viewed at the following web address:

https://www.rockvillemd.gov/documentcenter/view/36407

12. DOCUMENTS, MATERIALS AND DATA All documents materials or data developed as a result of this contract are the City's property. The City has the right to use and reproduce any documents, materials and data, including confidential information, used in the performance of, or developed as a result of this contract. The City may use this information for its own purposes, including reporting to state and federal agencies. The contractor warrants that it has title to or right to use all documents, materials or data used or developed in connection with this contract. The Contractor must keep confidential all documents, materials and data prepared or developed by the contractor or supplied by the City.

13. **ERRORS IN BIDS** When an error is made in extending total prices, the unit price will govern. Erasures in bids must be initialed by the bidder. Carelessness in quoting prices or in preparation of the bid will not relieve the bidder from performing the contract. Errors discovered after public opening cannot be corrected and the bidder will be required to perform if the bid is accepted.

14. **MISTAKES** Bidders are expected to be thoroughly familiar with all bid documents, including all addenda. No consideration will be granted for any alleged misunderstanding of the intent of the contract documents. In the process of assembling and binding the bid documents individual pages or drawings may have been inadvertently omitted. Each bidder shall carefully and thoroughly examine these bid documents for completeness. No claim of any bidder will be allowed on the basis that these bid documents are incomplete.

15. **PRICES** Bids must be submitted on a firm, fixed price, F.O.B. destination basis only unless otherwise specified herein.

16. **PROMPT PAYMENT DISCOUNTS** All discounts other than prompt payment are to be included in the bid price. Prompt payment discounts will be considered in the evaluation of your bid if the discount on payment is not conditioned on payment being made in less than thirty (30) days from receipt of invoice.

17. **BIDDER'S PAYMENT TERMS** The City will reject as non-responsive a bid under this solicitation, which is conditioned on payment of proper invoices in less than thirty (30) days. However, this does not preclude a bidder from offering a prompt payment discount for payment of proper invoices in less than thirty (30) days.

18. **INTEREST IN MORE THAN ONE BID AND COLLUSION**

Multiple bids uploaded/received in response to a single solicitation from an individual, firm, partnership, corporation, affiliate, or association under the same or different names will be rejected. Reasonable grounds for believing that a bidder is interested in more than one bid for a solicitation both as a bidder and as a subcontractor for another bidder will result in rejection of all bids in which the bidder is interested. However, a firm acting only as a subcontractor may be included as a subcontractor for two or more bidders submitting a bid for the work. Any or all bids may be rejected if reasonable grounds exist for believing that collusion exists among any bidders. Bidders rejected under the above provisions shall be disqualified if they respond to a re-solicitation for the same work.

19. **QUALIFICATION OF THE BIDDER** The City shall have the right to take such steps as it deems necessary to

determine the responsibility of the bidder to perform the obligations under the contract and the bidder shall furnish to the City all such information for this purpose as the City may request. The right is reserved to reject any bid where an investigation of available information does not satisfy the City that the bidder is qualified to carry out the terms of the contract.

20. **PLACING OF ORDERS** Orders against contracts will be placed with the Contractor on a Purchase Order (or Procurement Card – currently Mastercard) executed by the Purchasing Agent or designee. Where Master Agreements have been released by the City, orders may be placed directly with the Contractor by authorized personnel in the ordering Department(s). Issuance of all purchase orders will be contingent upon appropriation of funds by the Mayor and Council and encumbrance of such funds after July 1st of each year, as provided by the City Code.

21. **INSPECTION OF THE WORK SITE** Each bidder shall visit the site of the proposed work and become fully acquainted with the existing conditions and fully informed as to any facility involved, and the difficulties and restrictions attending the performance of this contract. Applicable drawings, technical specifications and contract documents should be thoroughly examined. The successful bidder shall in no way be relieved of any obligation due under the executed contract by the failure to examine any form of legal instrument or to visit the site.

22. **RISK OF LOSS AND CONDITION OF SITE** The City makes no representation and assumes no responsibility for the condition of the site or applicable structures on the site. The contractor shall accept the site and the contents thereon in the condition in which they are represented. Any damages or loss whatsoever while the contract is in effect (whether by reason of fire, theft, breakage or other happenings) shall not relieve the Contractor from any obligations under this contract. The Contractor shall store any materials on site as not to damage the materials and shall maintain such storage areas, as directed by the City, in hazard free condition.

23. **SUBCONTRACTORS** Nothing contained in the contract documents, shall create any contractual relationship between the City and any subcontractor or sub-subcontractor.

Unless otherwise indicated, the successful contractor who will subcontract the delivery, installation, or portion of the work herein described will submit to the Project Manager, prior to the start of work, the following information: 1) A description of the items to be subcontracted, 2) the subcontractor name, address, and telephone number, and 3) the nature and extent of the work utilized during the life of the contract. Subcontractors shall be considered agents of the Contractor, who shall be held fully accountable for all of the subcontractor services, labor, and materials relative to the contract.

24. **BID BOND** Bids must be accompanied by an electronic copy of a certified check or bid bond for five percent (5%) of the total amount of the bid, made payable to the Mayor and Council of Rockville, where the original security instrument must be mailed to City of Rockville, Procurement Division, 111 Maryland Avenue, Rockville, Maryland 20850, referencing the solicitation number. AIA Bond forms are acceptable. Bonds must be issued by a surety licensed to do business in the State of Maryland. The City reserves the right to disqualify any bid, in any instance, where the City cannot locate the mailed, original security instrument. The City shall not be liable for any certified checks it cannot locate, or in any instance where a certified check is cashed by any individual not employed by the City of Rockville. Bid bonds will not be returned.

25. **EXECUTION OF AGREEMENT/BONDS** Subsequent to award and within fifteen (15) calendar days after the prescribed forms are presented to the Contractor, the Contractor shall execute and electronically deliver to the City the required Agreement and Bonds, where two (2) sets of the original agreement and original bonds must be mailed to City of Rockville, Procurement Division, 111 Maryland Avenue, Rockville, Maryland 20850.

Bonds shall be in effect during the original term of the contract and during the guarantee and warranty period required under the Contract, unless otherwise stated therein.

PERFORMANCE BOND The Contractor shall execute and deliver to the City the required Performance Bond for 100% of the bid amount.

PAYMENT BOND For a contract exceeding One Hundred Thousand Dollars ($100,000) the payment bond shall be in an amount equal to 100% of the bid amount. For a contract exceeding Twenty-Five Thousand Dollars ($25,000) but not exceeding One Hundred Thousand Dollars ($100,000) the payment bond shall be in an amount equal to fifty percent (50%) of the bid amount. Bonds shall be executed by a surety company authorized to do business in the State of Maryland.

The successful bidder may request that in lieu of bonds, the City accept the equivalent in the form of a certified check or other security. Such requests will be accepted or rejected by the City Manager. If rejected, the successful bidder will be required to furnish the bonds or forfeit the bid bond. The City shall not be liable for any certified checks it cannot locate, or in any instance where a certified check is cashed by any individual not employed by the City of Rockville.

Failure of the successful bidder to execute the agreement and supply both the electronic versions and original versions of the required forms within fifteen (15) calendar days shall constitute a default. Any instance where the City cannot locate the mailed versions of the agreement or bonds shall also constitute a default. The successful bidder shall forfeit to the City as liquidated damages for such failure or refusal an amount in cash equal to the security deposited with the bid.

The City may either award the contract to the next low responsive and responsible bidder or re-advertise the bids, and may charge against the original bidder the difference between the amount of the bid and the amount for which a contract for the work is subsequently executed. If a more favorable bid is

received by a re-advertising, the defaulting bidder shall have no claim against the City for a refund.

26. **LEGAL REQUIREMENTS** All materials, equipment, supplies and services shall conform to applicable Federal, State, County and City laws, statutes, rules and regulations. The Contractor shall observe and comply with all Federal, State, County and City laws, statutes, rules and regulations that affect the work to be done. The provisions of this contract shall be governed by the laws of the State of Maryland.

27. **INDEMNIFICATION OF THE COUNCIL** The Contractor shall indemnify and save harmless the Mayor and Council from all suits, actions and damages or costs, of every name and description to which the Council may be subjected or put by reason of injury to persons or property as a result of the work, whether caused by negligence or carelessness on the part of the Contractor, or subcontractors or agents thereof.

28. **DELIVERY** Time is of the essence. The Contractor shall expedite the work and achieve substantial completion within the contract time. If time limits are not specified, state the number of days required to make delivery/completion in the space provided. Defective or unsuitable materials or workmanship shall be rejected and shall be made good by the Contractor, not withstanding that such materials/workmanship have been previously been overlooked and accepted.

29. **CHANGES IN QUANTITIES/ITEMS** The City reserves the right to add or delete any item(s) from the bid in whole or in part at the City's discretion as given in the Bid or Proposal wherever it deems it advisable or necessary so to do and such changes shall in no way vitiate the contract nor affect the bid prices for any item or remaining work. Unit prices submitted in the bid shall not be increased or decreased regardless of changes in quantity. The City may waive minor differences in specifications in bids provided these differences do not violate the specifications' intent nor materially affect the operation for which the items or services are being purchased

    The Contractor will be paid for the actual amount of authorized work done or material furnished under any item of the bid at the price bid and stipulated for such item. In case any quantity is increased, the Contractor shall not be entitled to any increased compensation over and above the unit price bid for such item, or any claim for damages on account of loss of anticipated profits should any quantities be decreased. The Contractor shall be responsible for confirming the accuracy of the specified quantities prior to ordering materials or supplies and the City's payment shall be based on the actual quantities incorporated in the work and not the quantities specified in the bid document. The quantities must not exceed the Contract specified quantities without specific written authorization of the Project Manager and it is the Contractor's responsibility to obtain said authorization.

30. **MATERIALS** All materials shall be new and free from defects. They shall be standard products of current manufacture. Unless otherwise noted in the contract documents, the Contractor shall abide by specific manufacturer instructions and recommendations on installation and operation.

31. **BRAND NAME OR EQUAL** Identification of an item by manufacturer's name, trade or brand name, or catalog number is for information and establishment of a quality level desired and is not intended to restrict competition. Bidders may offer any brand which meets or exceeds the specification, unless 'brand name only' is specified. Bids on other makes and/or models will be considered provided the bidder clearly states on the proposal what is being proposed and forwards with the bid complete descriptive literature indicating how the characteristics of the article being offered will meet the specifications. The City reserves the right to accept or reject items offered as an equal.

32. DEFECTIVE MATERIALS/WORKMANSHIP
Defective or unsuitable materials or workmanship shall be rejected and shall be made good by the Contractor. If the work shall be found to be defective or to have been damaged before final acceptance, the Contractor shall make good such defect in a manner satisfactory to the City, without extra compensation even though said defect or injury may have not been due to any act or negligence of the Contractor.

33. **TIME OF BEGINNING AND COMPLETION** Unless otherwise stipulated in the bid document, the Contractor shall begin work on the Contract within ten (10) working days after the mailing of a purchase order and shall diligently prosecute the same, so that it shall be fully completed within the time as stated in the contract. The Contractor shall not commence any work under the Contract until a written Purchase Order is received from the Purchasing Agent.

34. **FAILURE TO COMPLETE WORK ON TIME/ LIQUIDATED DAMAGES** The Contractor accepts this contract with the understanding and intention to perform fully and in an acceptable manner within the time stated. Should he fail to complete fully, to all intent and purpose, the work specified in the time specified, or within the time as it may have been extended by the City, the Contractor shall pay, for each calendar day that any work shall remain uncompleted, not including Sundays, the sum of $400 per calendar day or such other amount as specified in the Special Provisions. This sum is hereby agreed upon, not as a penalty, but as liquidated damages and the City shall have the right to deduct the amount of such damages from any moneys due the Contractor under this Contract.

    The City shall recover such Liquidated Damages by deducted the amount thereof out of any moneys due or that may become due the Contractor, and if said moneys are insufficient to cover said damages, then the Contractor or the Surety shall pay the amount due upon demand by the City.

35. **AUTHORITY OF THE CITY MANAGER IN DISPUTES** Except as may otherwise be provided by the final agreement, any dispute concerning a question of fact arising under the agreement signed by the City and the Contractor which is not disposed of by the final agreement shall be decided by the City Manager who shall notify the Contractor in writing of his determination. The Contractor shall be afforded

the opportunity to be heard and offer evidence in support of the claim. Pending final decision of the dispute herein, the Contractor shall proceed diligently with performance under the agreement signed by the City and the Contractor. The decision of the City Manager shall be final and conclusive unless an appeal is taken pursuant to the City Purchasing Ordinance.

36. **CONTRACT DELAYS/EXTENSION OF TIME** The Contractor shall pursue the contract so as to complete all work within the time allotted in the bid document. The completion date as set in the bid document allows for inclement weather, holidays and coordination with other companies. If the Contractor is delayed in the delivery of the supplies, equipment or services by any act of neglect of the City or by a separate Contractor employed by the City, or by any changes, strikes, lockouts, fires, unusual delays in transportation or delay authorized by the City, the City shall review the cause of such delay and shall make an extension of time if warranted. All claims for extensions must be in written notice sent to the Project Manager within ten (10) calendar days after the date when such alleged cause for extension of time occurred. All such claims shall state specifically the amount of time of the delay the Contractor believes to have suffered. If written notice is not received within the prescribed time the claim shall be forfeited and invalidated.

37. **CONTRACT DELAYS - NO DAMAGE CLAIMS ACCEPTED** The Contractor shall make no claim for extra monetary compensation for delays, whether ordered by the City or not, caused by delays in funding, governmental approvals, private or public companies' actions, inclement weather, site conditions, or from any cause whatsoever. The Contractor shall adjust its operation to continue the work at other locations under the contract, if available, and as directed by the City. If it is necessary to discontinue the work temporarily, the Contractor shall resume work within 48 hours of notice from the City. The City may adjust the completion date to compensate for the lost day(s) on a day-for-day basis, if the City finds that the Contractor could not make up for such lost day(s) by reallocating its forces or rescheduling the work, up to the time remaining on the original schedule at the time of shutdown.

38. PROGRESS SCHEDULE AND SCHEDULE OF OPERATIONS The construction of this project will be planned and recorded with an Activities Chart Project Schedule (AC) and Written Narrative (WN) unless specifically determined to be unnecessary by the Project Manager. The AC Project Schedule and Written Narrative will break down, in detail, the time (working days or completion date) involved in performing major construction activities for the duration of the project. The AC Project Schedule shall be used for the coordination and monitoring of major work under the contact including the activities of subcontractors, vendors and suppliers. The AC Project Schedule shall be prepared in accordance with the requirements of the Maryland State Highway Administration Standard Specifications for Construction and Materials dated January 1982, and the errata and addend thereto, subsequent supplement(s) and the Special Provisions as set forth in this Invitation for Bids, unless otherwise directed or approved by the Project Manager. The schedule shall be consistent with the contract specified completion date(s) and/or working days. The Contractor is responsible for preparing the initial AC Project Schedule and Written Narrative.

Preparation of Initial Schedule - Within 10 calendar days after notification that the Contractor is the apparent successful bidder, the Contractor will complete development of a initial AC Project Schedule and Written Narrative (describing the logical time representations as proposed in the AC Project Schedule), and submit 2 (two) copies of each AC and WN to the Project Manager for review and approval.

Updating Project Schedule**:** At any time that it becomes apparent the schedule, created as above and approved by the Project Manager, is not being implemented, either because the work or service is ahead or behind schedule, the Contractor shall immediately notify the Project Manager and shall submit a revised, written, updated AC and WN for the Project Manager's review, revision and approval The contractor shall make every effort to meet the original completion date and/or working days allowed unless otherwise so directed by the Project Manager.

Payment for Schedule AC/WN**:** No special compensation will be paid for preparing or revising the above project AC/WN as the cost shall be considered incidental to the contract with compensation incorporated into the bid items(s).

39. **SPECIFICATIONS** The Construction Specifications for this contract will be those shown below and additions included in the bid document, if applicable. In the event of conflict, the City determination shall govern. The following specifications and standards, listed below, including all subsequent addenda, amendments and errata are made part of this contract to the extent required by the references thereto:

    1. Maryland Department of Transportation, State Highway Administration, "Standard Specifications for Construction and Materials" (Maryland Department of Transportation, State Highway Administration), dated January 2008 and all errata and addenda thereto. MDSHA Book of Standards for Highway and Incidental Structures.
    2. Montgomery County Department of Transportation "Montgomery County Road Construction Code and Standard Specifications."
    3. Standard Specifications of WSSC dated July 2005.
    4. Montgomery County Department of Transportation "Design Standards" August 1991.
    5. Maryland Dept of the Environment "1994 Standards and Specifications Soil Erosion and Sediment Control"
    6. The U. S. Department of Transportation, Federal Highway Administration, "Manual on Uniform Traffic Control Devices" latest edition.
    7. Montgomery County Noise Ordinance.

40. **CONTRACT DOCUMENTS** The contract documents are complementary and what is required by any one shall be binding as if required by all. Words and abbreviations that have well known technical or trade meanings are used in the contract documents in accordance with such recognized meanings. On drawings, the figured dimensions shall govern in the case of discrepancy between the scales and figures.

Anything shown on the construction plans and not mentioned in the specifications or mentioned in the specifications and not shown on the plans shall have the same effect as if shown or mentioned respectively in both.

Prior to bidding, the Contractor should obtain clarification of all questions which may have arisen as to intent of the contract document, or any actual conflict between items in the contract documents. Should the Contractor have failed to obtain such clarification, then the City may direct that the work proceed by any method indicated, specified or required, in the judgment of the City, by the contract documents. Such direction by the City shall not constitute the basis for a claim for extra costs by the Contractor. The Contractor acknowledges that he had the opportunity to request clarification prior to submitting his bid to the City and that he is not entitled to a claim for extra cost as a result of failure to receive such clarification.

Any discrepancies which may be discovered during the execution of work between actual conditions and those represented by the contract documents shall be reported to the City and work shall not proceed until written instruction has been received by the contractor from the City.

41. **INTERPRETATION** Any questions concerning terms, conditions and definitions of the contract and bidding regulations shall be directed in writing to the Contract Officer. Any questions concerning the technical specifications and drawings shall be directed in writing to the Project Manager. The submission of a bid shall be prima facie evidence that the bidder thoroughly understands the terms of the contract documents. The Contractor shall take no advantage of any error or omission in these contract documents.

42. **PRE-CONSTRUCTION CONFERENCE** A pre-construction conference may be held in person or virtually following contract award. The meeting must be attended by the Contractor. No compensation will be made by the City to the Contractor for meetings.

43. **EMERGENCY CONTACT** The Contractor shall provide at least two local telephone numbers which may be used for contacting an official of the Contractor at all times, 24 hours per day, seven days per week: at which numbers person(s) of responsibility will be available to respond to City directives relative to the contract. The Contractor shall have available sufficient personnel and equipment to immediately respond to emergency needs, as determined by the City. There will be no special compensation paid for this requirement but the cost is to be considered incidental to the other contract pay items.

44. **SUPERVISION AND DIRECTION OF WORK** The work shall be under the general supervision of the Project Manager. While it is intended that the Contractor shall be allowed in general to carry on the contract in accordance with such general plan as may appear to the Contractor most desirable, the Project Manager, at the Project Manager's discretion, may from time to time, direct the order in which, and points at which, the work shall be prosecuted and may exercise such general control over the conduct of the work at a time or place, as shall be required, in the Project Manager's opinion, to safeguard the interests of the City, and the Contractor shall have no claims for damages or extra compensation on account of the fact that it shall have been necessary to carry on the work in different sequence from that which the Contractor may have contemplated. The Contractor shall immediately comply with any and all orders and instructions given by the Project Manager, but nothing herein contained shall be considered such an assumption of control over the work by the City or the Project Manager as to relieve the Contractor of any obligations or liabilities under the contract.

45. **INSPECTION** Work and materials will be inspected promptly to see that the same strictly correspond with the drawings and specifications, but if, for any reason, delay should occur in connection with such inspection, the Contractor shall have thereby no claim for damages or extra compensation. Materials and workmanship shall be always subject to the approval of the Project Manager, but no inspection, approval or acceptance of any part of the work or of the materials used therein, nor any payment on account thereof shall prevent the rejection of said materials or work at any time thereafter, should said work or materials be found to be defective or not in accordance with the requirements of the contract. Any costs for any "re-inspection" of the job shall be the responsibility of the contractor.

46. **TERMINATION FOR DEFAULT** The contract may be cancelled or annulled by the City in whole or in part by written notice of default to the Contractor upon nonperformance or violation of contract terms and an award made to next low Bidder, or, articles specified may be purchased on the open market similar to those so terminated. In either event, the defaulting Contractor (or his surety) shall be liable to the City for costs to the City in excess of the defaulted contract prices: provided, that the Contractor shall continue the performance of this contract to the extent not terminated under the provisions of this clause.

47. **TERMINATION FOR CONVENIENCE** This Contract may be terminated, in whole or in part, upon written notice to the Contractor when the City determines that such termination is in its best interest. The termination is effective 10 days after the notice is issued, unless a different time is given in the notice. The City is liable only for payment for goods and services delivered and accepted or approved by the City prior to the effective date of the termination.

48. **EMPLOYEES** The Contractor shall employ only competent, skillful persons to do the work, and whenever the Project Manager shall notify the Contractor in writing that any person employed on the work is, in his opinion, incompetent, disobedient, disorderly, discourteous or otherwise unsatisfactory, such person shall be discharged from the work and shall not again be employed for this contract except with the consent of the Project Manager.

49. **NON-WORK DAY** The City observes the following holidays: New Year's Day, Martin Luther King's Birthday, President's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Thanksgiving Friday and Christmas Day, all days of general and congressional elections throughout the State, and a five-day work week.

The Contractor will not be permitted to do any work which requires the services of the City's inspection, supervisory or line and grade forces on the days on which the above mentioned holidays are observed by the City or on Saturdays or Sundays, unless otherwise authorized by the Project Manager in writing. However, the Contractor, with verbal permission of the Project Manager, may be permitted to perform clean up and such other items for which no specific payment is involved on Saturdays and holidays.

The normal number of working hours per day on this Contract will be limited to eight, unless otherwise authorized by the Project Manager in writing.

In case of an emergency, which may require the services of the City on Saturdays, Sundays, holidays or longer than eight hours per day, the Contractor shall request permission of the Project Manager to work. If, in the opinion of the Project Manager the emergency is bona fide, he will grant permission to the Contractor to work such hours as may be necessary. Also, if in the opinion of the Project Manager, a bona fide emergency exists, the Project Manager may direct the Contractor to work such hours as may be necessary whether the Contractor requests permission to do so or not.

50. **LANGUAGE** The Contractor shall appoint one or more crewmembers or supervisors to act as liaison with the City and emergency services personnel. All liaisons shall be fluently bilingual in English and the Contractor's employees' language(s), and at least one liaison shall be present at each work site at all times when any of the Contractor's employees or agents are at the site.

51. IMMIGRATION REFORM AND CONTROL ACT
The Contractor awarded a contract pursuant to this bid shall warrant that it does not and shall not hire, recruit or refer for a fee, for employment under the contract, an alien knowing the alien is an unauthorized alien and hire any individual without complying with the requirements of the Immigration Reform and Control Act of 1986 (the Act), including but not limited to any verification and record keeping requirements. The Contractor shall further assure the City that, in accordance with the Act, it does not and will not discriminate against an individual with respect to hiring, or recruitment or referral for a fee, of the individual for employment or the discharging of the individual from employment because of such individual's national origin or in the case of a citizen or intending citizen, because of such individual's citizenship status.

52. **EQUAL EMPLOYMENT OPPORTUNITY** The Contractor will not discriminate against any employee or applicant for employment because of age (in accordance with applicable law), ancestry, color, national origin, race, ethnicity, religion, disability, genetics, marital status, pregnancy, presence of children, gender, sexual orientation, gender identity or expression, or veteran status. The Contractor will take affirmative action to ensure that applicants are employed, and the employees are treated fairly and equally during employment with regard to the above. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment, layoff or termination, rates of pay or other form of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. Contractors must also include the same nondiscrimination language in all subcontracts.

If the Contractor fails to comply with nondiscrimination clauses of this contract or fails to include such contract provisions in all subcontracts that subcontractors will not discriminate against any employee or applicant for employment in the manner described above, this contract may be declared void AB INITIO, cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further contracts with the City of Rockville. Any employee, applicant for employment, or prospective employee with information concerning any breach of these requirements may communicate such information to the City Manager who shall commence a prompt investigation of the alleged violation. Pursuant to such investigation, the Contractor will permit access to the Contractor's books, records, and accounts. If the City Manager concludes that the Contractor has failed to comply with nondiscrimination clauses, the remedies set out above may be invoked.

53. **ETHICS REQUIREMENTS** In accordance with the City's financial disclosure and ethical conduct policy and/or ordinances a prerequisite for payment pursuant to the terms of this contract is that the Contractor may be required to furnish explicit statements, under oath, that the City Manager, and/or any other officer, agent, and/or employee of the City, and any member of the governing body of the City of Rockville or any member or employee of a Commission, Board, or Corporation controlled or appointed by the City Council, Rockville, Maryland has not received or has not been promised directly or indirectly any financial benefit by way of fee, commission, finder's fee, or in any other manner, remuneration arising from directly or indirectly related to this contract, and that upon request by the City Manager, or other authorized agent, as a prerequisite to payment pursuant to the terms of this contract, the Contractor will furnish to the Mayor and Council of the City of Rockville, under oath, answers to any interrogatories to a possible conflict of interest has herein embodied.

54. **DRAWINGS TO BE FOLLOWED** The approved drawings, profiles and cross sections on file with the City will show the location, details and dimensions of the work contemplated, which shall be performed in strict accordance therewith and in accordance with the specifications. Any deviations from the drawings or specifications as may be required by the exigencies of construction in all cases will be determined by the Project Manager. There shall be no such deviations without the written authorization of the Project Manager. On all drawings, etc., the figured dimensions shall govern in the case of discrepancy between the scales and figures. The Contractor shall take no advantage of any error or omission in the drawings or specifications. The Project Manager shall make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the specifications and of the drawings as construed by the Project Manager whose decision shall be final.

55. **CERTIFICATION** Under no circumstances will Contractors be paid for materials utilized on any City contract unless certified to by the Project Manager. The Contractor must not incorporate any materials into a City project without prior authorization and certification of the Project Manager, unless necessary to eliminate or avoid hazardous conditions. Under these emergency circumstances the responsibility for notification to the Project Manager and quantity/quality confirmation rests with the Contractor and must be obtained within 24 hours of the work.

56. **DECISIONS AND EXPLANATIONS BY PROJECT MANAGER** The Project Manager shall make all necessary explanations as to the meaning and intent of the specifications and drawings, and shall give all orders and directions, either contemplated therein or thereby, or in every case in which a difficult or unforeseen condition arises during the prosecution of the work. Should there be any discrepancies or should any misunderstanding arise as to the intent of anything contained in the drawings and specifications, the decision of the Project Manager shall be final and binding. The Project Manager shall in all cases determine the amount, quality, acceptability and estimates of the work to be paid for under the Contract, and shall decide all questions in relation to the work. In case any questions arise between parties relating to the Contract, such decision and estimate shall be a condition precedent to the right of the Contractor to receive payment under that part of the Contract which is in dispute.

57. **WORK TO BE DONE AND MATERIALS TO BE FURNISHED** The Contractor shall do all the work and furnish all the labor, materials, tools, and equipment necessary or proper for performing the work required by the Contract, in the manner called for by the drawings and specifications and within the Contract time. The Contractor shall complete the entire work together with such extra work as may be required, at the prices fixed therefore, to the satisfaction of the Project Manager and in accordance with the specifications and drawings.

58. **NOTIFICATION TO OTHER AGENCIES** The Contractor will be responsible for notifying all concerned agencies affected by the work a minimum of 48 hours in advance of any activity, as prescribed by said agencies, including, but not limited to: the Washington Gas, PEPCO, Verizon Comcast Cable, Transcontinental Gas, City of Rockville Utilities Division, Montgomery County Government, State Highway Administration and the Washington Suburban Sanitary Commission. The Contractor must notify MISS UTILITY at 1-800-257-7777 a minimum of 72 hours and no more than 5 working days prior to removal of any pavement or beginning any excavation. There shall be no measurement or direct payment to the Contractor for such notification, working around, the protection of, or repair of damage to such existing utilities caused by the proposed construction activities directly or indirectly.

59. **PERMITS AND REGULATIONS** Unless stipulated elsewhere in these specifications, the Contractor shall be responsible for obtaining and paying for all applicable permits. Where signatures of the City are required in connection with the obtaining of such permits, certificates, etc., the Contractor shall prepare the proper paperwork and present it to the City for signature. City of Rockville Permit fees shall be waived. If the Contractor ascertains at any time that any requirement of this contract is at variance with applicable laws, ordinances, regulations and/or building codes, notification to the Project Manager shall be made immediately and any necessary adjustment to the contract shall be made. Without proper notice to the Project Manager, the Contractor shall bear all costs arising from the performance of work the Contractor knows to be contrary to such laws, ordinances, etc.

60. **EXCAVATION** Unless specifically provided in the specifications, all trench and roadway excavation is hereby unclassified as to the character of materials. The lump sum or unit price, as specified, for or including excavation shall constitute full payment for removal and disposal of all materials, regardless of type, encountered in trenching and roadway excavation, within the limits of this Contract, as necessary and as shown to be removed on the Contract drawings and/or as directed by the Project Manager, except as otherwise provided for under this Contract. All bidders are hereby directed to familiarize themselves with all site conditions including subsurface and the proximity of adjacent features.

61. **SERVICE OF NOTICES** The mailing a written communication, notice or order, addressed to the Contractor at the business address filed with the City, or to his office at the site of the work shall be considered as sufficient service upon the Contractor of such communication, notice or order; and the date of said service shall be the date of such mailing. Written notice shall also be deemed to have been duly served if delivered in person to the individual or member of the firm or to any officer of the corporation for whom it was intended if delivered or sent by registered or certified mail to the last known address.

62. **PATENT RIGHTS** Whenever any article, materials, equipment, process, composition, means, or things called for by these specifications is covered by letters of patent, the successful bidder must secure, before using or employing such article, material etc., the assent in writing of the Owner or Licensee of such Letters of Patent and file the same with the City.

    The said assent is to cover not only the use, employment, and incorporation of said article, material, equipment, process, composition, combination, means, or thing in the construction and completion of the work but also the permanent use of said article, material, etc., thereafter by or on behalf of the City, in the operation and maintenance of the project for the purposes for which it is intended or adapted. The Contractor shall be responsible for any claims made against the City, its agents and employees or any actual or alleged infringement of patents by the use of any such patented articles, etc., in the construction and completion of the work, and shall save harmless and indemnify the City, its agents and employees from all costs, expenses, and damages, including Solicitor's and Attorney's fees which the City may be obligated to pay by reason of any actual or alleged infringement of patents used in the construction and completion of the work herein specified.

63. **CARE AND PROTECTION OF WORK** From the commencement of the Contract until its completion, the Contractor shall be solely responsible for the care of the work and all injury or damage to the same, from whatever cause, shall be made good by the Contractor at the Contractor's own expense, before the final estimate is made. The Contractor shall provide suitable means of protection for all materials intended to be used in the work and for work in progress, as well as completed work.

64. **ABANDONMENT OF OR DELAY IN WORK** If the work under the Contract shall be abandoned by the Contractor, or if at any time the Project Manager shall be of the opinion and shall so certify, in writing, to the Contractor, that the performance of the Contract is unnecessarily or unreasonably delayed, or that the Contractor has violated any of the provisions of the Contract or is executing the same in bad faith or if the work is not fully completed within the time specified for its completion, together with such extension of time as may have been granted, the City by written notice, may order the Contractor to discontinue all work there under, or any part thereof, within the number of days specified on such notice. At the expiration of said time the Contractor shall discontinue the work, or such part thereof, and the City shall have the power, by Contract, or otherwise, to complete said work and deduct the entire cost thereof from any monies due or to become due the Contractor under the Contract. For such completion of work the City may, for itself or its Contractor, take possession of and use or cause to be used any or all materials, tools, and equipment found on the site of said work. When any part of the Contract is being carried on by the City, as herein provided, the Contractor shall continue the remainder of the work in conformity with the terms of the Contract and in such manner as not to interfere with the City's workmen.

65. **SUBLETTING OR ASSIGNING OF CONTRACT** The City and the Contractor each bind themselves, their partners, successors, assigns and legal representatives of such other parties in respect to all covenants, agreements, and obligations contained in the contract documents. Neither party to the contract shall sublet, sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of the work provided for therein, or of his right, title or interest therein to any person, firm or corporation without the written consent of the other party, nor shall the Contractor assign any monies due or to become due hereunder without the previous written consent of the City.

66. **NO WAIVER OF CONTRACT** Neither the acceptance by the City or its Project Manager nor any order, measurement, certificate or payment of money, of the whole or any part of the work, nor any extension of time nor possession taken by the City or its Project Manager shall operate as a waiver of any portion of the Contract, or any right to damage therein provided. The failure of the City to strictly enforce any provision of this contract shall not be a waiver of any subsequent breach of the same or different nature.

67. **DUTIES, OBLIGATIONS, RIGHTS AND REMEDIES** The duties and obligations imposed by the contract documents and the rights and remedies available there under shall be in addition to and not a limitation of the duties, obligations, rights and remedies otherwise imposed or available by law, unless so indicated.

68. **IMPLIED WORK** All incidental work required by the drawings or specifications for which no payment is specifically provided and any work or materials not therein specified which are required to complete the work and which may fairly be implied as included in the Contract, and which the Project Manager shall judge to be so included, shall be done or furnished by the Contractor without extra compensation. The intent is to prescribe a complete work or improvement which the Contractor undertakes to do in full compliance with the contract documents together with any authorized alterations, special provisions and supplemental agreements.

69. **MEASUREMENT OF WORK AND MATERIAL** The work and material to be paid for will be measured and determined by the Project Manager according to the specifications and drawings, and the working lines that may be given. No allowance will be made for any excess above the quantities required by the specifications, drawings and lines on any part of the work, except where such excess material has been supplied or work done by order of the Project Manager and in the absence of default or negligence on the part of the Contractor. Should the dimensions of any part of the work or of the materials be less than those required by the drawings or the directions of the Project Manager, only the actual quantities placed will be allowed in measurement.

70. **EXTRA COSTS** If the contractor claims that any instructions by the contract documents or otherwise involve extra compensation or extension of time, a written protest must be submitted to the Project Manager within ten (10) calendar days after receipt of such instructions and before proceeding to execute the work, stating in detail the basis for objection. No such claim will be considered unless so made.

71. **CONTINGENT ITEMS & QUANTITIES** Items and quantities identified as being contingent are provided in the Contract for use when and as directed by the Project Manager. These items shown on the Plans or in the specifications are established for the purpose of obtaining a bid price. The quantities for these contingent items may be increased or decreased without any adjustment to the Contract unit price bid or the contingent items may be deleted entirely from the Contract by the Project Manager without negotiation. The Contractor shall submit no claim against the City for any adjustment to the Contract unit price bid, should the contingent items be increased, decreased or eliminated entirely. Payment for any contingent items used will be made on the basis of the quantities as actually measured and as specified in the Specifications. Materials, Construction Requirements and Basis of Payment shall be as specified elsewhere in the Specifications, Plans or Special Provisions.

72. **CHANGES IN THE SCOPE OR EXTRA WORK** The City, without invalidating the contract, may issue written changes in the work consisting of additions, deletions, or modifications with the contract sum and completion date being adjusted accordingly. All such changes, or additional work must be authorized in writing by the Purchasing Agent prior to starting such work. Costs

shall be limited to the cost of materials, labor, field supervision and field office personnel directly involved in and attributed to the change. All costs and/or credits to the City for a change in the work shall be determined by the unit price bid or by mutual agreement.

The Contractor shall do all work that may be required to complete the work contemplated at the unit prices bid or at a lump sum price to be mutually agreed upon.

The Contractor shall perform extra work, for which there is no quantity or price included in the Contract, whenever it is deemed necessary or desirable, to complete fully the work as contemplated, and such work shall be done in accordance with the specifications therefore, or in the best workmanlike manner as directed. Where such a price or sum cannot be agreed upon by both parties, or where this method of payment is impracticable, the Project Manager may order the Contractor to do such work on a force account basis, which will be paid for as follows.

73. **FORCE ACCOUNT WORK** When the Contractor is required to perform work as a result of additions or changes to the contract for which there are no applicable unit prices in the contract, the City and Contractor shall make every effort to come to an agreed upon price for the performance of such work. If an agreement cannot be reached, the City may require the Contractor to do such work on a force account basis to be compensated in accordance with the following:

A. Labor**.** For all labor and for foremen in direct charge of the specific operations the Contractor shall receive the actual wages for each and every hour that said labor and foremen are actually engaged in such work.

B. Materials. For materials accepted by the Project Manager and incorporated into the project, the Contractor shall receive the actual cost of such materials, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth). Excess materials delivered to the job site and not incorporated into the project will not be paid for and it is the Contractor's responsibility to remove said excess material from the job site.

C. Equipment. For any machinery or special equipment (other than small equipment tools, whether rented or owned), the use of which has been authorized in writing, by the Project Manager the Contractor shall receive the rates agreed upon in writing before such work is begun which price shall include fuel, oil and miscellaneous necessities, or the Contractor shall receive those rates which may be specified elsewhere in the Special Provisions. For the purpose of definition, equipment with a new cost of $1000 or less will be considered small tools and equipment.

D. Materials and Supplies Not Incorporated in the Work. For materials and supplies expended in the performance of the work (excluding those required for rented equipment) and approved by the Project Manager, the Contractor shall receive the actual cost of such materials and supplies used.

E. Subcontractors**.** The Contractor shall receive the actual cost of work performed by a subcontractor. Subcontractor's cost is to be determined as in A., B., C., and D. above, plus the fixed fee for overhead and profit allowance computed as in G.

F. Superintendence. No additional allowance shall be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided

G. Contractor's Fixed Fee**.** The procurement officer and the Contractor shall negotiate a fixed fee for force account work performed pursuant to this specification by his force and by his subcontractors. The City shall pay 10 percent of A as compensation for overhead and profit for the work performed. The Contractor shall proceed diligently with the performance of the force account work to completion. The Contractor's fixed fee shall include an amount equal to the sum of 65 percent of A, which shall include, but not be limited to the following:

(1) Compensation for all costs paid to, or in behalf of, workmen by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits that may be required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed in the work; and

(2) Bond premiums, property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions and Social Security taxes on the force account work.

In addition, the Contractor's fixed fee may include an amount not to exceed 10 percent of B. unless specifically authorized by the Project Manager in advance of the work; 5 percent of D., and 5 percent of E with the exception of that portion chargeable to equipment as defined above.

H. Compensation. The compensation as set forth above shall be received by the Contractor as payment in full for change order work done on a force account basis. At the end of each day, the Contractor's representatives and the Project Manager, shall compare records of the cost of work as ordered on a force account basis. Differences shall be immediately resolved and any unresolved difference shall be brought to the attention of the Project Manager by written notice from the Contractor within two working days of the occurrence.

I. Statements**.** No payment will be made for work performed on a force account basis until the Contractor furnishes the Project Manager duplicate itemized statements of the cost of such force account work detailed as to the following:

(1) Name, classification, date, daily hours, total hours, rate, and extension for such workmen. Contractor shall provide certified payrolls

(2) Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment. Contractor shall provide original receipted invoices.

(3) Quantities of materials, prices and extensions. Contractor shall provide original receipted invoices.

(4) Transportation of materials. Contractor shall provide original receipted invoices.

If, however, the materials used in the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the original invoices the statements shall contain or be accompanied by an affidavit of the Contractor which shall certify that such materials were taken from his stock that the quantity claimed was actually used and that the price and transportation of the material as claimed represent actual cost. Any request for payment under this Section should be submitted in the order outlined by the above.

The Contractor shall be responsible for all damages resulting from work done on a force-account basis, the same as if this work had been included in the original Contract.

Work performed without previous written order by the Project Manager will not be paid.

74. **ALLOWANCES** Whenever an allowance is mentioned in the specifications, then the contractor shall include in his contract sum the entire amount of such specified allowances. The expenditure of these allowances is to be at the Purchasing Manager's direction. However, the allowance expenditure is limited to items properly inferable from the title and description of the allowance. Unexpended balances are to be credited to the City. Compensation payable to the contractor for expenditure of allowances directed by the Purchasing Manager shall be based on the cost to the contractor as shown by actual invoices or receipts, and no additional overhead or profit shall be payable to the contractor for such allowances.

75. **PROGRESS PAYMENTS AND RETAINAGE** The Contractor shall submit a detailed application for payment on a monthly basis, preferable on an AIA G702 form. Such application for payment, notarized, if required, must be accompanied by supporting data and documents substantiating the Contractor's right to payment and reflecting a five percent (5%) retainage.

Applications for payment shall not include payment for equipment or materials delivered to the site but not installed or for materials or equipment properly stored off-site unless specifically approved by the Project Manager. If such approval is granted, the Contractor must submit with the application for payment, bills of sale or other such documentation satisfactory to the City to establish the City's title to such materials or equipment or otherwise to protect the City's interest, including applicable insurance and transportation to the site for materials and equipment stored off site. Such approvals are typically reserved for "big ticket" items that individually would exceed five percent (5%) of the bid total. The Contractor shall promptly pay each subcontractor and supplier for work completed upon receipt of payment from the City the amount to which said subcontractor is entitled, reflecting any percentage retained from payments to the Contractor on account of each subcontractors work. The Contractor shall, by an appropriate agreement with each subcontractor, require each subcontractor to make prompt payments to his subcontractors in a similar manner.

The City shall be under no obligation to pay or to see to the payment of any moneys to any subcontractor except as may otherwise be required by law.

No Certificate of Payment or partial or entire use of the facility by the City shall constitute an acceptance of any work which is not in accordance with the Contract Documents.

Payments Withheld – The City may decline to certify payment or because of subsequently discovered evidence or observations, nullify the whole or any part of any Certification of Payment previously issued, as may be necessary to protect the City from loss because of: (1) defective work not remedied, (2) third party claim filed or evidence indicating probable filing of such claim, (3) failure of the Contractor to make payments properly to subcontractors or suppliers, (4) reasonable evidence that the work can not be completed for the unpaid balance of the contract sum, (5) reasonable evidence that the work will not be completed within the Contract time, (6) persistent failure to carry out the work.

76. **FINAL PAYMENT REQUEST** Upon reaching substantial completion, as defined by receipt of occupancy permit or when all related punch list items have been completed, whichever date is later, the Contractor may submit a written Application for Final Payment. All supporting documentation and data shall be submitted with the Request for Final Payment as is applicable to the monthly Requests for Payment referenced heretofore.

Out of the amount representing the total of the final payment request the City shall deduct five (5%) percent, which shall be in addition to any and all other amounts which, under the Contract, it is entitled or required to retain and shall hold said sum for a period of one hundred and twenty (120) days after the date of acceptance of the work by the City.

Within thirty (30) days after the approval of the final payment request, the City will pay to the Contractor the amount remaining after deducting from the total amount of the final estimate all such sums as have hereto before been paid to the Contractor under the provision of the Contract and also such amounts as the City has

or may be authorized under the Contract to reserve or retain.

Neither the final payment nor the remaining retainage shall become due until the Contractor submits to the Project Manager:

1. An affidavit that all payrolls, bills for materials and equipment and other indebtedness connected with the work for which the City or his property might in any way be responsible, have been paid.
2. Consent of surety to final payment, and
3. If requested, data establishing payment or satisfaction of obligations, such as receipt, release and waivers of liens arising out of the Contract;
4. All punch list items are completed to the satisfaction of the Project Manager.

If any subcontractor refuses to furnish a release or waiver of liens required by the City, the Contractor may furnish a bond satisfactory to the City to indemnify him against any such lien. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the City all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorney fees.

Acceptance by the Contractor of final payment shall operate as a release to the Mayor and Council and every officer and agent thereof, from all claims and liabilities to the Contractor for anything done or furnished or relating to the work under the contract.

77. **RELEASE OF RETAINAGE** Upon the expiration of the aforesaid period of one hundred and twenty (120) days succeeding the date of acceptance, the City will pay to the Contractor all sums reserved or retained, less such amount as it may be empowered under the provisions of the Contract to retain.

78. **GUARANTEES / WARRANTIES** All guarantees and warranties required shall be furnished by the Contractor and shall be delivered to the Project Manager before final payment is made. The Contractor guarantees that the items conform to the contract documents.

79. **GUARANTEE PERIOD** The Contractor shall warrant and guarantee the work required under this Contract for a period of twelve (12) months from the date of Final Acceptance. The Contractor warrants and guarantees to the City, that materials and equipment furnished under the Contract shall be of good quality and new unless otherwise required or permitted by the Contract Documents, that all work will be in accordance with the Contract Documents, and that all work will be of good quality, free from faults and defects. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the City, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

The Contractor's obligation to perform and complete the work in a workmanlike manner, free from faults and defects and in accordance with the Contract Documents shall be absolute. The Contractor shall remedy, at his own expense, and without additional cost to the Owner, all defects arising from either workmanship or materials, as determined by the City, or City's representative. The obligations of the Contractor under this Paragraph shall not include normal wear and tear under normal usage.

If the Contractor does not, within ten (10) days after notification from the Project Manager, signify his intention in writing or in action to correct work, as described above, then the Project Manager may proceed with the work and charge the cost thereof to the account of the Contract as herein before provided.

80. **Substantial Completion.** Sufficient completion of the project or the portion thereof to permit utilization of the project, or portion thereof for its intended purpose. Substantial completion requires not only that the work be sufficiently completed to permit utilization, but that the City can effectively utilize the substantially completed work. Determination of substantial completion is solely at the discretion of the City. Substantial completion does not mean complete in accordance with the contract nor shall substantial completion of all or any part of the project entitle the Contractor to acceptance under the contract.

At such time as the Contractor has completed the work and prior to requesting a final inspection, the Contractor shall make written request for an inspection for substantial completion. Such request shall be made no less than seven (7) calendar days prior to the requested date of inspection. An inspection will be made by the City and a determination will be made as to whether or not the work is in fact substantially complete and a "punch list" will be developed. "Punch Lists" containing numerous items or items which may affect the intended use of the work will be considered cause to delay issuance of a document of Substantial Completion. Operation and Maintenance manuals shall be submitted and approved prior to issuance of any document of Substantial Completion.

81. **TRANSFER OF TITLE** The Contractor warrants that title to all work, materials and equipment covered by the Application for Payment will pass to the City either by incorporation in construction or upon the receipt of payment by the Contractor, free and clear of all liens, claims, interests or encumbrances, and that no work, materials, or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any person performing the work at the site or furnishing materials or equipment for the project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other persons.

82. **USE OF PREMISES** Whenever, in the opinion of the Project Manager, any portion of the work is completed or is in an acceptable condition for use, it shall be used for the purpose it was intended, however, such use shall not be held as acceptance of that portion of the work, or as a waiver of any of the provisions of the Contract.

83. **DETERMINATION OF CITY'S LIABILITY** The acceptance by the Contractor of the final payment made as aforesaid shall operate as and be a release to the City and every officer and agent thereof, from all claims by and liabilities to the Contractor for anything

done or furnished for or relating to or affecting the work under the contract.

84. **NO LIMITATION OF LIABILITY** The mention of any specific duty or liability of the Contractor in any part of the specification shall not be construed as a limitation or restriction upon any general liability or duty imposed upon the Contractor.

85. **PRESERVATION OF MONUMENTS AND TREES** The Contractor shall be responsible for the preservation of all public and private property, trees, monuments, highway signs, markers, fences, and curbs or other appurtenances, and shall use every precaution to prevent damage or injury thereto. Any expense necessary to provide adequate protection, whether such designated item be on or off the right-of-way, shall be assumed by the Contractor.

86. **PUBLIC ACCESS** The Contractor shall at all times conduct the work in such a manner as to insure the least obstruction to traffic practicable. The convenience and safety of the general public and the residents along the improvement shall be provided for in an adequate and satisfactory manner. Fire hydrants shall be kept accessible to fire apparatus at all times. Handicap access shall remain accessible.

87. **HAZARDOUS AND TOXIC SUBSTANCES** Manufacturers and distributors are required by Federal "Hazard Communication" provision (29 CFR 1910.1200), and the Maryland "Access to Information About Hazardous and Toxic Substances" law to label each hazardous material or chemical container, and to provide Material Safety Data Sheets to the purchaser. The Contractor must comply with these laws and must provide the City with copies of all relevant documents, including Material Safety Data Sheets, prior to performance of services or contemporaneous with the delivery of goods.

88. **MAINTENANCE OF VEHICULAR TRAFFIC (if applicable** Unless otherwise directed by the Project Manager, traffic must be maintained on all roadways within the construction area continuously or with the least amount of interruption during the construction period necessary to minimize accidents and accident severity and maintain safety while at the same time minimizing inconvenience to the traveling public and the Contractor. The Project Manager shall have the exclusive right to order a road to be closed or to remain open. No equipment will be stored or permitted to stand within the limits of the roadway right-of-way where traffic must be maintained. Any earth dropped on the surface of the existing road shall be removed immediately to avoid possible hazardous conditions. The Contractor shall prepare and submit a Traffic Control Plan (TCP) for the Project Manager's review, revision, and approval, at least ten days before beginning work, unless otherwise directed.
All Traffic Control Devices shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), latest edition (and all revisions). With the approved TCP implemented, the Contractor will be permitted to work with the following provisions: All traffic lanes must be restored at the end of each day unless specifically authorized otherwise, in advance, by the Project Manager:

The City reserves the right to modify or expand on the methods of traffic control specified and to restrict working hours if, in the opinion of the Project Manager, the Contractor's operations are a detriment to traffic during rush hour periods.

Signs on fixed supports shall be mounted on two posts. Signs mounted on portable supports are suitable for temporary conditions. During periods of partial shutdown, or extended periods when no work is being performed, the Contractor shall remove or adequately cover all construction signs as directed by the Project Manager.

The Contractor shall be responsible for removing, storing, covering, and resetting all existing traffic signs and delineators that become inapplicable and will confuse traffic during the various stages of construction, the cost of which shall be included in the price for Maintenance of Traffic or in the absence of such a pay item it shall be accomplished at no additional compensation, as incidental to the contract. Any signs lost or damaged will be replaced by the Contractor at its expense.

The Contractor shall provide, maintain in new condition, and move when necessary or directed all traffic control devices used for the guidance and protection of vehicles.

The Contractor shall be responsible for providing the appropriate signs to reflect varying traffic patterns prior to the commencement of a new stage of construction.

Traffic must be safely maintained at all times throughout the entire length of the project. No additional compensation shall be paid to the contractor for traffic maintenance, even if the contract time exceeds the contractually specified completion date or working days.

When required lane shifts are implemented, existing painted lane markings no longer applicable shall be removed to the satisfaction of the Project Manager.

Temporary crash cushions are to be installed as shown on the Plans. Unless otherwise specified, sand containers shall be used. The crash cushions shall conform to Subsection 104.10 of the MDSHA Specifications.

Crash cushions shall be reset to reflect changing traffic patterns caused by different stages of Traffic Control. The crash cushions shall be reset at locations shown on the Plans or as directed by the Project Manager.

Should any of the sand container components be damaged during the resetting of the system or during the course of the project, the Contractor shall replace the damaged components at its own expense.

The Contractor shall have flaggers on this Project for the purpose of controlling traffic while maneuvering heavy equipment. This may require a temporary lane closure in any of the specified Traffic Control Phases. These temporary lane shutdowns shall be kept to a minimum and the normal traffic pattern for the Traffic Phase shall be restored as quickly as possible. The Contractor shall comply with Section B-20 of the MUTCD regarding flagger signing.

Prior to stopping work each day the Contractor will be required to reshape all graded areas and eliminate all drop-offs not protected by barriers by filling with compacted stone at maximum of 8:1 slope.

All barriers and barricades shall be adequately illuminated at night, as specified herein, and all lights for this purpose shall be kept operative from sunset to sunrise.

No work shall be commenced in any stage of construction until the barriers and barricades for that stage, indicated on the Plans, or as specified by the Project Manager, are completely in place. The Contractor will be solely responsible for all accidents and damages to any persons and property resulting from its operations. Compliance with prescribed precautions contained herein or in the MDSHA Specifications or Manual On Uniform Traffic and Control shall not relieve the Contractor of its primary responsibility to take all necessary measures to protect and safeguard the work, nor relieve the Contractor from any responsibilities prescribed by GP-7 of the January 2001 MDSHA Standard Specifications for Construction and Materials.

The Contractor shall notify and obtain approval in writing from the Project Manager, at least 48 hours before changing any Traffic Control Phase.

Any construction materials or debris dropped on the roadway surface shall be removed immediately to avoid possible hazardous conditions.

Materials The Contractor shall provide, maintain in first class condition, replace and move when necessary or directed all materials, devices, flagging, etc., required to maintain traffic in accordance with the Traffic Control Plans or as directed by the Project Manager. Reference is made to the latest edition of the MUTCD, wherein all such items are fully described with regard to use, application, warranties, size, color, placement, etc., and wherein typical traffic control device layouts are shown, as all such devices and techniques planned for use on this project shall strictly conform to the Manual's request except as noted on the Plans.

When any of the following items have been established on the Plans or as directed by the Project Manager, the Specifications will be adhered to in accordance with the respective sections.

Lights, Warnings, Etc: - All banners and imitation barrels shall be adequately illuminated at night, and all lights for this purpose shall be kept operative from sunset to sunrise.

Steady burning warning lights shall be used to delineate channelization through and around obstructions in a construction or maintenance area, on detour curves, on lane closures, and in other similar conditions (MUTCD 6E-4, 6E-5). Flashing warning lights shall be the means for identifying a particular and individual hazard and shall not be used in sequence, in clusters, or for delineation (MUTCD: 6E-5, 6E-6).

Where noted on the plans the first two (2) warning signs shall include a "High Level Warning Device." In addition to the flags the signs shall also be equipped with a Type "B" High Intensity Flag Warning Light. This device must meet the requirements of MUTCD 6C-11 and 6E-5. The device shall be incidental to the Temporary Traffic Sign item if provided for, otherwise the costs shall be considered incidental and no special compensation will be paid.

Barriers**:** Temporary concrete barriers shall be installed on the roadway approaches as shown on the plans or as approved in writing.

Any permanent facilities damaged as a result of anchoring temporary concrete barriers (anchor holes. etc.) shall be repaired to the satisfaction of the Project Manager using an epoxy grout or other material as may be specified by the Project Manager. Epoxy grout shall consist of sand and epoxy, mixed by volume according to manufacturer's recommendations.

Method of Measurement and Basis of Payment: All work and materials required under the TCP not covered or specified as a pay item on the price proposal form will be included in the lump sum price bid for Maintenance of Traffic. In the absence of such an item the Contractor agrees that there will be no special compensation paid for maintenance of vehicular traffic as described above and the cost shall be considered incidental to the contract and compensated as part of other contract bid item(s).

89. **PARKING, STORAGE AND STAGING AREAS** Parking, storage and staging areas for the Contractor's use during the Project must have prior approval of the Project Manager. All areas used for storage of equipment or material shall be restored to their original condition, immediately upon completion of the work. No additional compensation will be provided for restoring, re-grading, placement of topsoil, and seed and mulch in these areas.

90. **PEDESTRIAN TRAFFIC** Pedestrians shall be safeguarded by the use of signs lights, barricades and barriers as shown on the traffic control plan and/or directed by the Project Manager. Pedestrian traffic shall be maintained at all times unless specifically authorized otherwise, in advance, by the Project Manager. The Contractor shall submit a pedestrian traffic safety plan in accordance with the MUTCD, incorporating safety measures and other provisions to fully implement the intent of this paragraph. All work and materials required to prepare and implement the pedestrian traffic safety plan shall be considered incidental to the contract and there shall be no special compensation paid for this item unless special pay items are included in the Price Proposal page. No additional compensation shall be paid for maintenance of vehicular and pedestrian traffic if for whatever reason the project time extends beyond the contract specified completion date or working days.

91. **HANDICAP ACCESS** Where handicap access exists within the line of work under this contract it will be the contractor's responsibility to maintain said access during the life of this contract. This service is considered to be incidental to this contract and no special compensation will be paid for this service unless provided on the Price Proposal page.

92. **TOILET FACILITIES** Toilet facilities meeting MOSHA standards shall be provided at the job site for all projects exceeding $100,000 in value and at all other job sites when directed by the City. No special compensation shall be paid unless specifically provided for in the Price Proposal page of this solicitation.

93. **STAKEOUT-CONSTRUCTION CONTROL** Survey construction control provided by the City shall be limited to the baseline with stations not over 100 feet, and the elevation of the top of each marked point. P.C.s, P.T.s. P.I.s, P.V.T.s, and at least one point on the tangent beyond the end of each curve will be staked. The Contractor shall request baseline stakeout a minimum of five days in advance of construction. Stakeout data other than stated above will be furnished by the construction Contractor per MDSHA Section 815 for structures, otherwise per WSSC specs. section 01000(H) and as described in detail below and in these specifications. The City's responsibility for stakeout for the entire project shall be limited to that data described above and this shall be provided only once. The Contractor shall preserve or otherwise ensure adequate survey controls exist throughout the life of the contract.

    Surveys and stakeout shall be accomplished by the Contractor as outlined above and in conformance with WSSC specifications Section 01000-10-l l(H), entitled "Construction Stakeout By Contractor."

    The provisions therein are primarily for pipeline stakeout. The Contractor's responsibilities under this contract are hereby expanded to include, in addition to pipeline stakeout, similar responsibilities for all phases of stakeout necessary to construct all facilities under this contract including but not limited to clearing and grubbing excavation, pavement, curbs and gutters, storm drainage pipes and facilities, culverts, structures, storm water management facilities, street lights, traffic signal conduits and components, noise walls, retaining walls, ditches and sediment control features.

    The stakeout and survey record data shall be preserved and turned over to the City for filing following completion of specific components of work.

    Method of Measurement and Payment Generally, stakeout shall be considered incidental to the contract and no special compensation shall be paid, unless a specific pay item is included in the contract Price Proposal page of this contract. Where payment is provided, progress payments for stakeout shall be made based on the percentage resulting from the price bid for stakeout divided by the total bid, multiplied by the monthly payment exclusive of the stakeout payment, except the final payment shall be adjusted as necessary to equal the total price bid for stakeout.

    Grade Sheet by Contractor: Grade sheets showing hub and design elevations for roadway, water mains, drainage structures and piping, walks, lights, infiltration facilities clearing/grubbing, excavation, and related components will be provided by the construction Contractor at least 8 hours in advance of construction and will be subject to approval by the Project Manager. Stakeout for curb and gutter in all vertical and horizontal curves is to be at intervals of 25 feet or less unless otherwise specifically authorized by the Project Manager. This work is considered incidental to the contrast and no extra compensation will be paid.

94. **DEBRIS** Under no circumstance will any open fires be permitted within the City of Rockville. All debris will be removed and hauled from site (except when otherwise specifically authorized in the bid document) and disposed in accordance with Local, State and Federal laws in effect at the disposal site. No special compensation will be paid as all costs for off-site disposal shall be included in the applicable bid prices and considered incidental to the contract.

95. **CLEAN UP** In addition to any provisions regarding clean up in the bid document, clean up, including the restoration of areas of construction, shall proceed as quickly as is practicable. The period between construction and final clean up shall normally not exceed one week. If at any time during the course of the work the cleaning operation in any given area becomes delinquent in the opinion of the Project Manager he may order that construction be stopped until such cleaning is completed. Any such order shall not extend the Final Completion date under this contract. Unless otherwise indicated, all materials razed, demolished, or otherwise removed from the work site shall become the property of the Contractor and shall be disposed of legally and properly off site at his expense.

    Upon Final Completion of the work and before acceptance and final payment shall be made, the Contractor shall clean and remove from the street, footways, lawns, and adjacent property, all surplus and discarded materials, rubbish and temporary structures, restore in an acceptable manner all property, both public and private, which has been damaged during the prosecution of the work and shall leave the work area in a neat and presentable condition throughout the entire length of the project under contract.

    If the Contractor fails to clean up at Final Completion of the work, the City may do so and the cost thereof shall be charged to the Contractor.

INSURANCE REQUIREMENTS

Prior to the execution of the contract by the City, the Contractor must obtain at their own cost and expense and keep in force and effect during the term of the contract including all extensions, the following insurance with an insurance company/companies licensed to do business in the State of Maryland evidenced by a certificate of insurance and/or copies of the insurance policies. The Contractor's insurance shall be primary. The Contractor must electronically submit to the Purchasing Division a certificate of insurance prior to the start of any work. In no event may the insurance coverage be less than shown below.

Unless otherwise described in this contract the successful contractor and subcontractors will be required to maintain for the life of the contract and to furnish the City evidence of insurance as follows:

MANDATORY REQUIREMENTS FOR INSURANCE
Contractor's insurance coverage shall be primary insurance as respects the City, its elected and appointed officials, officers, consultants, agents and employees and any insurance or self-insurance maintained by the City, shall be excess of the Contractor's insurance and shall not be called upon to contribute with it.

Type of Insurance	Amounts of Insurance	Endorsements and Provisions
1. Workers' Compensation *2. Employers' Liability*	Bodily Injury by Accident: $100,000 each accident Bodily Injury by Disease: $500,000 policy limits Bodily Injury by Disease: $100,000 each employee	Waiver of Subrogation: **WC 00 03 13 Waiver of Our Rights to Recover From Others Endorsement signed and dated.**
3. Commercial General Liability a. Bodily Injury b. Property Damage c. Contractual Liability d. Premise/Operations e. Independent Contractors f. Products/Completed Operations g. Personal Injury	Each Occurrence: $1,000,000	City to be listed as additional insured and provided 30 day notice of cancellation or material change in coverage. **CG 20 37 07 04 and CG 20 10 07 04 forms to be both signed and dated.**
4. Automobile Liability a. All Owned Autos b. Hired Autos c. Non-Owned Autos	Combined Single Limit for Bodily Injury and Property Damage - (each accident): $1,000,000	City to be listed as additional insured and provided 30 day notice of cancellation or material change in coverage. **Form CA20 48 02 99 form to be both signed and dated.**
5. Excess/Umbrella Liability	Each Occurrence/Aggregate: $1,000,000	City to be listed as additional insured and provided 30 day notice of cancellation or material change in coverage.
6. Professional Liability	Each Occurrence/Aggregate: $1,000,000	

Alternative and/or additional insurance requirements, when outlined under the special provisions of this contract, shall take precedence over the above requirements in part or in full as described therein.

POLICY CANCELLATION
No change, cancellation or non-renewed shall be made in any insurance coverage without a thirty (30) day written notice to the City Purchasing Division. The Contractor shall electronically furnish a new certificate prior to any change or cancellation date. The failure of the Contractor to deliver a new and valid certificate will result in suspension of all payments and cessation of on-site work activities until a new certificate is furnished.

ADDITIONAL INSURED

The Mayor and Council of Rockville, which includes its elected and appointed officials, officers, consultants, agents and employees must be named as an additional insured on the Contractor's Commercial and Excess/Umbrella Insurance for liability arising out of contractor's products, goods, and services provided under this contract. Additionally, The Mayor and Council of Rockville must be named as additional insured on the Contractor's Automobile and General Liability Policies. Endorsements reflecting the Mayor and Council of Rockville as an additional insured are required to be submitted with the insurance certificate.

SUBCONTRACTORS

All subcontractors shall meet the requirements of this Section before commencing work. In addition, Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

CERTIFICATE HOLDER

The Mayor and Council of Rockville
IFB #11-23 Construction of a Bulk Sodium Hypochlorite System
City Hall
111 Maryland Avenue
Rockville, MD 20850

SPECIAL PROVISIONS

These Special Provisions are hereby made a part of the contract. In case of conflict with the terms and conditions or the Specifications of the City of Rockville, Montgomery County Government, the Washington Suburban Sanitary Commission, the Maryland State Highway Administration, the Maryland Department of the Environment or the Montgomery Soil Conservation District, the Special Provisions shall govern.

PROJECT DESCRIPTION

The project is for replacing the existing chlorine gas system to a bulk sodium hypochlorite system at Rockville's Water Treatment Plant; and all other work as shown on the contract documents and where specified herein. The water treatment plant is located in Montgomery County on Sandy Landing Road in Potomac, Maryland. The plant was originally built in 1958 with a 4 million gallons per day (MGD) capacity, then upgraded to its current capacity of 8 MGD in 1968. The project consists of the furnishing of all labor, materials, equipment, tools and services for the upgrades and other associated work as specified in the contract documents.

The Construction of a Bulk Sodium Hypochlorite System project scope of work includes but is not limited to the following:

- Demolition of the existing gas chlorine room and systems.
- Alterations to Chlorine Room exterior walls and interior floor as well as the addition of a containment system.
- Removal and replacement of chlorine feed system, HVAC systems; emergency eye wash/shower systems and fire protection systems.
- Installation of chlorine storage and day tanks, pump, piping, and control systems; and all other appurtenances.
- Works involves structural, electrical, mechanical, plumbing, fire protection and instrumentation systems.
- Demolition of the Chlorine Gas crane, monorail, and support structures
- Construct concrete overlay and other improvements around the Chlorine Gas Storage Platform.
- Remove and dispose of Silo #3, including all appurtenances within the Chemical Building and to include concrete floor improvements. (Bid Alternate #1).
- Maintain a temporary chlorine system for the duration of construction as per the contract documents.
- Obtain trade permits and coordinate inspections with Montgomery County Department of Permitting Services (DPS).

The Construction of a Bulk Sodium Hypochlorite System project scope also includes a contingent pay item to remove and dispose of Silo #3 (Bid Alternate #1):

- Removal and disposal of Silo #3 within the Chemical Building;
- Removal of all appurtenances associated with Silo #3 to include the concrete pad, equipment, materials conduit, feeder chute, hopper and bin;

- Pouring a new concrete floor within the void created by Silo #3.
- Include a submittal to be signed and sealed by a licensed professional engineer in the State of Maryland for the restoration of the concrete floor.

CONTRACT TERM

This contract will begin 10 working days from the date of issuance of a notice to proceed. All work associated with this project must be completed within 270 calendar days after the notice to proceed has been issued. It is possible that the City may issue a Limited Notice to Proceed (LNTP) to allow for mobilization, coordination, field measuring, shop drawing review/approval, submission of work plan and ordering long lead time components.

CONTRACT EXTENSIONS

The City reserves the right to extend the contract with the awarded contractor for more than one year which may include additional work, change orders or other services where applicable.

NOTICE TO PROCEED AND COMPLETION SCHEDULE

The contractually specified completion date and time shown herein below is to be strictly adhered to unless authorized or directed otherwise in writing by the Chief, Construction Management Division, DPW. The completion date, where specified, has an allowance for inclement weather and holidays. Time extensions for unusual conditions causing project delays not covered in these special provisions will be subject to the conditions covered under the GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS; however, no compensation above that indicated herein for specific items shall be paid to the Contractor for any delay, regardless of the source of delay.

The Contractor shall provide a bar-chart schedule at the Project Kick-Off Meeting or at such time as directed by the Chief, Construction Management, DPW but not more than once per month or with any change order. In addition, the contractor shall verbally provide updates to the Project Inspector as requested.

Construction of the WTP Electrical Distribution Systems Upgrade and Main Building Renovations project is ongoing at the time this IFB is issued. The contractor must coordinate the project schedule with the City of Rockville staff to avoid any construction conflicts.

CONSTRUCTION WORK HOURS

Normal working hours are from 7:00 am to 5:00 pm, Monday through Friday. Working outside of these hours must first be approved by the City. No work shall be permitted outside these hours unless written approval is obtained from the Chief, Construction Management Division or his/her designee.

COVID-19 PRECAUTIONS DURING CONSTRUCTION

Due to COVID-19, special precautions are required during construction, as recommended by the Centers for Disease Control (CDC) and the city of Rockville:

- Notify Contractor supervisor and stay at home if experiencing any symptoms (refer to CDC website for list of symptoms).

CONTRACT DOCUMENTS

In addition to the requirements of GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS, in the case of discrepancies in the Contract Documents and need for interpretation, the documents shall be given precedence in the following order:

- Change Orders
- Addenda
- Drawings
- Special Provisions
- Technical Specifications
- General Conditions and Instructions to Bidders (City of Rockville)
- Standard Details by others
- City of Rockville Standard Details for Construction
- Applicable Standards listed below

Any questions, requests for information or revisions to the specifications must be reviewed and approved by the City of Rockville.

APPLICABLE STANDARDS

As a minimum standard of quality workmanship, all work is to comply with the latest provisions and recommendation of the following documents in the following order of precedence. In the event of conflict, the City's determination shall govern.

- City of Rockville Standards and Details for Construction, latest edition.
- Washington Suburban Sanitary Commission, General Conditions and Standard Specifications, latest edition.
- Montgomery County Department of Public Works and Transportation Design Standards, latest edition.
- MDSHA "Standard Specifications for Construction and Materials" including all errata and addenda thereto and additions included in these special provisions, latest edition.
- MDSHA Book of Standards and Standard Specifications for Construction and Material, latest edition.
- MDE, WMA and SCS 2011 Maryland State and Specifications for Soil Erosion and Sediment Control, latest edition.
- American Society for Testing and Materials, "ASTM Standards," latest edition.
- American Water Works Association Standards (AWWA Standards), latest edition
- American Association of State Highway and Transportation Officials, "AASHTO Standards", latest edition
- American Concrete Institute (ACI) Standards, latest edition.

All references to the State of Maryland, State, S.R.C, State Roads Commission, State Highway Administration or Commission in the Special Provisions, Technical Specifications or Book of Standards shall be interpreted to refer to the City of Rockville Department of Public Works.

PERMITS

The Contractor is responsible for implementation and compliance with all conditions of all permits as listed below:

Maryland Department of the Environment. Permit No. 22-16-1003 issued on July 25, 2022 (Appendix B)

Montgomery County, Maryland. Building Permit (#995785) issued on March 1, 2023 (Appendix C).

City of Rockville. No City permits are required for this project.

The Contractor is responsible for all reporting, inspection requests, documentation and notifications associated with these permits. Compensation for implementation of the requirements of the above permits is to be included in appropriate bid items and no special compensation will be made.

PROJECT KICK-OFF AND PRE-CONSTRUCTION CONFERENCE

Upon issuance of the Notice to Proceed, the City may arrange a project kick-off meeting with all appropriate City staff and the Contractor. This will be either a virtual or office-based meeting to review the project requirements. The City will decide which City staff will attend. The Contractor shall arrange any pre-construction meetings required by associated permits and/or approvals (Montgomery County, Maryland). These pre-construction meetings shall be held on the project site among the Contractor, design engineer's representative, and appropriate City staff, including the Chief of Construction Management, Project Inspector, Sediment Control Inspector, and Engineering Project Manager.

All subsequent notifications for inspection and coordination with the City and all other agencies are the responsibility of the Contractor.

MOBILIZATION/DEMOBILIZATION

Mobilization shall include all activities and costs for transportation of personnel, equipment, and operating supplies to and from the site; establishment of offices, and other necessary facilities for the Contractor's operations at the site; premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable; and other items as specified in this specification. Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not included in the contract from the site; including the disassembly, removal and site cleanup/repair of offices, buildings, and other facilities assembled on the site for this contract. This work includes mobilization and any additional mobilization and demobilization activities, and costs as required during the performance of the contract. The Contractor shall provide and pay all the cost for temporary utilities including electricity, telephone and water. All temporary facilities shall be available for the duration of the project. The Contractor shall be responsible for compliance with code ordinances and requirements of local officials for temporary facilities, controls, and related health and safety requirements. It shall be the responsibility of the Contractor to provide all necessary electrical service. In the event electrical power will not be available, it shall be the Contractor's responsibility to provide any necessary generator to continue construction. The Contractor shall provide and pay all the cost for toilet facilities for all workmen, as required by local ordinances for complete and adequate sanitary arrangements. Sanitary facilities and the surrounding are shall be kept clean and neat at all times. They shall be located on the project site as approved by the City.

Payment of the Mobilization item will not be made more than once, regardless of the fact that the Contractor may have, for any reason, shut the work down on the project or moved their equipment away from the project and then back again.

VALUE ENGINEERING

The City will consider Value Engineering Change Proposals in accordance with Maryland SHA 2017 Standard Specifications for Construction and Materials section TC-2.10.

EMERGENCY CONTACT INFORMATION

The Contractor shall provide the name(s) and phone number(s) of a representative(s) of the Contractor who can be reached in case of an emergency. This shall be submitted to the City prior to the start of construction.

ALTERNATE/EQUIVALENT EQUIMENT OR MATERIAL

The Contractor may propose, in writing, to use alternate/equivalent equipment or material. The proposal should include a complete set of product specifications and justification for the substitution. The Contractor is responsible for all costs to review the proposal by the City's engineer of record. The City will transmit the proposal to the engineer of record that completed the design. The engineer of record will submit a cost proposal that consists of a review and recommendation whether the substitution is acceptable. If the Contractor approves the engineer's cost proposal it will be accounted for in an appropriate change order.

EMERGENCY INFORMATION

The Contractor shall post information concerning emergency medical, fire, rescue and hazardous waste phone numbers from which personnel on the site can obtain information if needed. The Contractor shall also list the name and number of a representative of the Contractor who can be reached in case of an emergency. The representative must be fluent in English. The emergency information shall be in a central position, located so it is visible and accessible 24 hours a day. The emergency information shall be posted for the entire length of the Contract.

CHLORINE GAS OPERATIONS SAFETY REQUIREMENTS

Contractor work includes a storage area for chlorine gas cylinders on-site. Prior to beginning work on or adjacent to the chlorine gas process, the following information must be coordinated:

1. City of Rockville will supply to the Contractor:
    a. Known potential fire, explosion, or toxic release hazards related to the contractor's work and the covered process area;
    b. Applicable provisions of the site emergency action plan, including evacuation and response procedures related to the accidental release of chlorine gas; and
    c. Safe work practices for employees in covered process areas including appropriate site access requirements for covered process area.
2. Contractor will supply to the City of Rockville:
    a. Identification of the individuals working onsite.
    b. Provide documentation of any licenses and safety related training completed for each individual working onsite. Some examples of safety related training for this type of work may include but not be limited to the following:
        i. Electric Power Generation, Transmission, and Distribution (or other electrical specific training if not a certified electrician);
        ii. Eye and Face Protection;
        iii. Lockout/Tagout;

iv. Machine Guarding;
v. Respiratory Protection;
vi. Scaffolding;
vii. Subpart S—Electrical Standard;
viii. Confined Space;
ix. Hazard Recognition; and
x. Ladder Safety.

c. Mandatory attendance at the City's Contractor orientation training which covers the process hazards and emergency evacuation and response procedures. Once training is completed with the City's operator on duty, sign the training document.
    i. As an alternative to Contractor employees' attendance at City contractor orientation training, the City may supply information and training materials to the Contractor. If this occurs, the Contractor will be responsible for documenting that each affected employee has received and understood the training before arriving onsite, and at least annually thereafter, and provide a record of the training to the City. The record shall include the identity of the Contract employee, the date of training, and the means used to verify that the employee understood the training.
d. Identification of potential hazards associated with the project and the mitigating safeguards that will be implemented to reduce hazards.

3. The Contractor is required to report any injury/illness that occurs or arises from their work onsite to the City's Project Manager. The Process Safety Incident Reporting Form must be completed by the Contractor or City and be submitted to the City's Safety and Risk department. Safety & Risk will maintain a Contractor injury/illness log for each injury/illness reported by the Contractor. If an incident resulted in, or could reasonably have resulted in, a catastrophic release of chlorine gas, an incident investigation shall be initiated.
4. The Contractor is required to report any unsafe conditions that they encounter immediately to the City personnel onsite and the City Project Manager. Contractors are expected to immediately cease any activities if they believe there is an imminent hazard to themselves, other contractors, City employees and/or facilities.
5. The Contractor is required to assure that each contract employee follows the safety rules of the facility including the chlorine process safe work practices. The performance of contractors and their employees while onsite shall be monitored by the City or designee and periodically documented. Issues identified during observation require immediate action by the Contractor to assure compliance with all safe work practices. Based on performance of the contractor and their employees while on-site, repeated issues or serious failures to observe City requirements can lead to revoking the Contractor's authorized status under this program.

PUBLIC UTILITIES

Comply with MDSHA Specifications under Sections GP 5.05, and GP 7.17 regarding public utilities.

It shall be the Contractor's responsibility to cooperate to the fullest extent possible with the utility owners in their work of adjusting the existing utilities to suit the proposed construction under this contract. All utilities, unless provided for on the contract drawings, shall be relocated or constructed by their respective owners.

The location of existing utilities shown on the plans and profiles are approximate only and it shall be the Contractor's responsibility to determine the exact location of the utilities prior to commencing work in all areas of possible conflict. All test pits must be completed in coordination with the City and the affected utility companies. The existence of utilities other than those shown on the plans is not known. If, during construction operations, the Contractor should encounter additional utilities, he shall immediately notify the City and take all necessary and proper steps to protect the continuance of service of such facilities.

The Contractor shall notify the utility owner and City when previously unknown or different utilities are encountered. The Contractor shall support and protect existing utilities whether or not shown on the plans at no additional cost to the City. The Contractor shall not receive compensation for the temporary relocation of or temporary installation of utilities that are constructed for the convenience of the Contractor.

In case of any damage to utilities by the Contractor, either above or below ground, the owner shall be immediately notified. The Contractor shall arrange for restoration of such utilities to a condition equal to that which existed before the damage was done, by repairing, rebuilding, or otherwise restoring as may be directed, and at the Contractor's entire cost and expense.

The Contractor shall take into consideration when preparing his bid, the costs associated with the coordination during construction with various utility companies for any relocation or installation by the utility companies which may be necessary in areas within, or adjacent to, the limits of his contract. No additional compensation or time extensions will be allowed the Contractor for work interruptions, changes in construction sequences, changes in methods of handling excavation and drainage, and changes in types of equipment used, made necessary by others performing work within, or adjacent to, the limits of this contract. The contract time as stated in this contract includes the time needed for utility adjustments and no extension of time will be granted for delays caused by utility adjustments.

All other expenses likely to be incurred by the Contractor as a result of working around and protecting utilities, as well as cooperating with the owners of same during the relocating of such facilities, will not be measured or compensated for under any stipulated pay item.

CONTACTS

The following utility companies and City departments may be affected by this project. It shall be the Contractor's responsibility to notify all utilities and/or City departments and coordinate his construction operations with them to avoid unnecessary delays.

- **City of Rockville**
  Acting Chief, Construction Management
  Mr. Michael Hershelman
  240-314-8543

- **City of Rockville**
  Operations & Maintenance Superintendent
  Mr. Steve Sokol
  240 -314-8567

- **City of Rockville**
  Project Inspector
  Mr. Dan Stevens
  240-314-8552

- **City of Rockville**
  Water Treatment Plant Superintendent
  Mr. Glenn Maggard
  240-314-8556

- **City of Rockville**
  Engineering Supervisor
  Mr. John W. Hollida
  240-314-8526

- **City of Rockville**
  Principal Civil Engineer
  Mr. Matthew Brew
  240-314-8516

- **City of Rockville**
  Water and Sewer Utilities
  240-314-8567

- **MISS UTILITY**
  1-800-257-7777 or 811

- **Pepco**
  202-872-2845

- **Transcontinental Gas**
  410-465-0960

- **Verizon**
  855-983-1424

- **Washington Gas**
  844-927-4427

- **Washington Suburban Sanitary Commission (WSSC)**
  301-206-8650

For Locations of Utilities, call "MISS UTILITY" at 811, 1-800-257-7777 or http://www.missutility.net/

Before interfering with any utility service, the Contractor shall notify the affected utility companies and affected property owners in advance and coordinate any required service interruption with the owner

and City. For any water service shut down, the Contractor must provide at least 21 calendar days' notice such that the City can provide proper notification.

The Contractor shall be responsible for contacting Miss Utility for the location of all utilities prior to the start of work.

PROTECTION OF WORK, PROPERTY AND PERSONS

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with this project. All necessary precautions shall be taken: to prevent injury to the Contractor's employees and other persons who may be affected by the project; to prevent damage to or loss of materials or equipment incorporated into the project; and to protect other property at or adjacent to the site including but not limited to trees, shrubs, lawns, walks, fences, pavements, roadways, utilities, structures, buildings, playgrounds and park facilities not designated for removal, relocation, or replacement in the course of construction; to provide warning signs as directed by the City for personnel and the public. Costs associated with this work are incidental to the work and no specific payments will be made.

SITE ACCESS

Access to the site is by public streets and thoroughfares. The gravel portion of Sandy Landing Road is a one-lane roadway that is also used by staff operators and used for chemical/material deliveries. After the completion of the project, all roads, driveways, parking lots, sidewalks, landscaping, fences, utilities, structures, buildings, lawns and other facilities not designated for removal, relocation or replacement that are damaged by the Contractor's actions shall be restored to the same condition or better. Prior to any construction activities, it is the Contractor's responsibility to document any existing damage or conditions indicative of substandard facilities. Costs associated with this work shall be included with the appropriate Pay Item.

Access to parks, easements across private property and other City-owned property in wooded areas must be coordinated with the City, Montgomery County, and the private property owners prior to the Contractor entering the property.

Due to the proximity of National Park Service property, private property and natural resources, the Contractor shall exercise extreme care in their construction operations.

ACCESS TO ADJACENT PROPERTIES

Access must be maintained to all properties abutting this project at all times. All work affecting private property is to be coordinated with the property owner by the Contractor. The Contractor shall maintain access to private residences and businesses at all times unless specifically approved in advance by the City.

ENTERING PRIVATE PROPERTY TO PERFORM WORK

The Contractor is to carefully examine the plans provided to ensure a clear understanding of the private property limits and work limits. Under no circumstances is the Contractor to enter beyond the specified limits or perform any work that affects private property without advance notice to and permission from the private owner and the City.

PRESERVATION AND RESTORATION OF PROPERTY & MONUMENTS

The Contractor is to carefully examine the plans provided with the contract drawings to ensure a clear understanding of the private property limits and work limits. The Contractor shall not enter upon private property for any purpose without first obtaining permission from the City and written permission from the property owner. The Contractor shall be responsible for the preservation of all public and private property, including but not limited to plants (trees, shrubs, and seasonal vegetation), lawns, walks, fences, pavements, roadways, utilities, structures, buildings, playgrounds and park facilities not designated for removal, relocation, or replacement, along and adjacent to the work areas, and shall use every precaution necessary to prevent damage or injury thereto. The Contractor shall take suitable precaution to prevent damage to underground or overhead public utility structures and must protect carefully from disturbances or damages all land monuments and property markers until the Project Inspector has witnessed or otherwise referenced their locations. All disturbed monuments and markers must be reset to their correct location by the Contractor at no additional compensation.

The Contractor shall be responsible for all damages or injury to public or private property of any character during the prosecution of the work, resulting from any act, omission, neglect or misconduct in his manner or method of executing said work satisfactorily, or due to the non-execution of said work, or at any time due to defective work or materials. When or where any direct or indirect damage or injury is done to public or private property or on account of any act, omission, neglect or misconduct in the execution of the work or in consequence of the non-execution thereof on the part of the Contractor, the Contractor must restore, at its own expense, such property to a condition similar or equal to rebuilding or otherwise restoring as may be directed by the City, or he shall make good such damage or injury in an acceptable manner. In case of the failure on the part of the Contractor to restore such property in a reasonable amount of time, or make good such damage or injury the City may, upon 24 hours' notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due or which may become due the Contractor under this Contract. City crews or another Contractor may accomplish said work.

After the completion of the project, all plants (trees, shrubs, and seasonal vegetation), lawns, walks, fences, pavements, roadways, utilities, structures, buildings, playgrounds and park facilities and other facilities not designated for removal, relocation or replacement that are damaged by the Contractor's actions shall be restored to the same condition or better. Prior to any construction activities, it is the Contractor's responsibility to document any existing damage or conditions indicative of substandard facilities. The Contractor shall provide pre-project photographs or videotape of the project work areas to the DPW Project Inspector. Costs associated with this work are incidental to the work and no specific payments will be made.

All of the requirements outlined above shall be considered incidental to this contract and no special compensation shall be paid.

SITE CONDITIONS

The Contractor shall visit each work site prior to performing the work to verify the existing conditions.

CONTRACTORS STAGING AND STORAGE

The Contractor will establish temporary staging areas as approved by the City. Clean up of each staging area shall occur within 48 hours of removal of all stored materials. Contractor shall cover topsoil, stone, and aggregate stockpiles with tarps to prevent sedimentation of the street.

Submit a sketch (a marked up set of plans is acceptable) and brief description for approval by the Chief, Construction Management, DPW showing the location of equipment and materials, location of portable sanitary toilet, and means and methods to protect pedestrians and existing public facilities (including trees) within the area as shown on the plans. This plan may have to be approved by the City Forester, if any grassed or tree areas will be utilized.

There shall be no payment for this work. It shall be considered incidental to the appropriate pay item.

TEMPORARY UTILITIES

The Contractor shall pay all fees, obtain necessary permits, and have meters installed for temporary utilities as may be required for the execution of this contract. As needed, the Contractor through direct local arrangements must obtain temporary electric service for the purpose of this contract with the electric company, PEPCO. The Contractor shall furnish and install all necessary temporary service drops, wiring, connections, etc., necessary for temporary service required by the Contractor. All costs associated with any temporary electric service required by the Contractor are considered incidental to other pertinent pay items. This item shall not be measured for payment.

The Contractor shall, at the beginning of the project, provide on the premises suitable temporary sanitary toilet facilities in accordance with the GENERAL CONDITIONS AND INSTRUCTIONS TO BIDDERS. The City shall approve the location of the sanitary toilet.

CONSTRUCTION STAKEOUT AND AS-BUILTS

Construction Stakeout shall be in accordance with Section 107 of the Maryland Department of Transportation, State Highway Administration's Standard Specifications for Construction and Materials, latest edition, with the following exceptions:

The Contractor shall be responsible for all construction stakeout. The Contractor shall complete project as shown on approved plans. The City will not provide any construction stakeout for this project. Contractors are to use benchmark and layout information as shown on the plans.

The Contractor shall provide as-built information. One set of redline as-builts shall be maintained and kept on-site at all times. Any deviations from approved plans shall be marked, in red, on the as-builts. As-built information shall consist of any deviation to the approved plan such as grading limits, slopes, types/length/height of restoration features, and any modifications to typical details. As-built requirements do not include any topographic survey.

Upon completion of project, submit as-builts for approval. Retainage shall not be released until as-builts are approved. The costs for stakeout and as-builts shall be considered incidental to the work and no specific payments will be made.

A copy of the Department of Public Works As-built Plan Requirements is attached in Appendix A. The City will provide an electronic CAD file of the layout information for the Contractor. The Contractor must complete an agreement for receipt of the electronic file.

PRECAST STRUCTURES

The Contractor may substitute comparable pre-cast inlets for those specified herein, if they have been approved for use by the Montgomery County Government, the Washington Suburban Sanitary

Commission or the MDSHA. The Contractor shall be responsible for engineering modifications and field stakeout to piping alignments and other components if required to accommodate the pre-cast units. The structures must be channelized per WSSC Standards and Specifications. The Contractor shall submit shop drawings for all precast structures and shall be received by the City at least 10 business days prior to fabrication. Shop drawings shall be sealed by a Professional Engineer licensed in the State of Maryland. Shop drawings must be approved by the Professional Engineer who sealed the design drawings for conformance to plan requirements. Fabrication shall not occur until such approval is obtained from the design engineer. Prior approval of the City is required for substitutions.

AERIAL ELECTRIC LINES

The Contractor shall be aware that State law requires that a 10-foot radial clearance shall be maintained for all construction equipment and materials in relation to electric lines carrying 750 volts or more. Because the State law is more stringent than the Federal laws, the State law shall be considered the minimal distance.

NOISE CONTROL MEASURES

All work must comply with the noise ordinance requirements for Montgomery County. A copy of the ordinance enforced by the Department of Environmental Protection (DEP) is attached to these contract documents in **Appendix D** for observation and compliance. With City approval, the Contractor may request a waiver through Montgomery County. The Contractor is fully responsible to submit the request and comply with any conditions of the waiver approval. The Contractor shall consider the processing time of this request, which includes a public notice element, when scheduling their work.

WATER POLLUTION CONTROL MEASURES:

The Contractor shall not discharge or permit discharge into the waters, canals, ditches, or drainage system any fuels, oils, bitumen, garbage, sewage or other materials which may be harmful to fish, wildlife or vegetation or that may be detrimental to outdoor recreation. The Contractor shall be responsible for investigation and complying with all applicable federal, state and local laws and regulations governing pollution of water. All work under this Contract shall be performed in such a manner that objectionable conditions will not be created in waters through or adjacent to the project areas.

AIR POLLUTION CONTROL MEASURES:

All fine-grained, loose materials hauled to or from this project shall be covered to prevent spillage and blowing. Material, which is not covered after notification by the City, will not be accepted for use on this project. This material will not be included in measurement for payment.

Burning will not be permitted.

ENVIRONMENTAL PROTECTION MEASURES:

Impervious barriers, (i.e., plastic, metal drip pans, etc.) shall be placed under any compressors, generators, welding machines, etc., to prevent oils, solvents, organic compounds, or other contaminants from leaching into the soil. Any oils, solvents, organic compounds, or contaminants spilled on the site during the process of the work shall be immediately removed and cleaned up by the Contractor. Any earth contaminated by a spill shall also be removed and replaced with new certified clean material to the satisfaction of the City and the Maryland Department of the Environment (MDE). If the City has to

remove the oils, solvents, organic compounds, contaminants, or earth, the City may deduct the costs of removal and clean up from the total contract amount owed the Contractor.

EROSION AND SEDIMENT CONTROLS

The Contractor is responsible for adhering to Montgomery County's laws and ordinances regarding sediment control. The Contractor shall be responsible for coordinating all work, and for notifying Montgomery County:

- Upon installation of all erosion and sediment control devices to schedule a "Notice to Proceed" inspection prior to commencing work;
- Prior to removing sediment control devices; and
- Upon completion of final grading, establishment of ground covers and approved land stabilization.
- During the progression of all work, the Contractor shall make periodic inspections and maintain sediment control devices, including cleaning and routine maintenance as directed or necessary, to ensure that the intended purpose is accomplished. Under no circumstances shall sediment be allowed to enter private properties, storm drains or County/Federal waterways.

When directed in the field by the Project Inspector, the Contractor shall be required to make adjustments in location and/or increase or decrease quantities of sediment control measures and provide temporary stabilization measures.

All sediment control measures shall be installed and maintained as shown on the Contract Documents, approved plans and details per latest City of Rockville Standards, Maryland Department of the Environment's 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, in compliance with Montgomery County, Maryland and the MDE/WMA Notice of Intent (NOI) General Permit for construction activities, and as directed by the Project Inspector. Please refer to Maryland Department of Transportation, State Highway Administration's Specifications entitled, "Standard Specifications for Construction and Material" latest edition, revisions thereof, or additions thereto. Comply with MSHA specifications section 308.02 Material and section 308.03 Construction.

Furnish and install temporary erosion and sediment controls. The Contractor is to protect the integrity of the erosion control measures installed. The erosion control measures shall be provided until such times as the temporary ground cover is sufficiently developed and the Project Inspector gives written authorization to remove said measures. The Contractor shall comply with all local, state and federal laws, ordinances, and regulations pertaining to erosion, sediment and pollution control, including those promulgated by the State of Maryland, and shall indemnify and hold harmless the City from and against all claims, damages, losses and expenses resulting from such work.

The Contractor shall have an employee present on site at all times who has met the requirements for certification of the Responsible Personnel training in erosion and sediment control according Maryland State Law. This employee shall have sufficient authority to install, maintain, adjust or otherwise implement approved sediment control measures.

The Contractor shall take all measures to control erosion and sedimentation at construction site, including borrow and waste areas and temporary access roads, and at off-site areas especially vulnerable to damage from erosion and sedimentation. All erosion and sediment control measures will

be subject to approval by the City. All erosion and sediment control measures shall be implemented prior to any construction occurring. All temporary erosion and sediment control measures shall be removed within thirty (30) days after completion of construction and establishment of permanent erosion control.

Work shall be scheduled so that areas subject to erosion are exposed for the shortest possible time. Only those trees, shrubs and grasses shall be removed that are necessary for construction as designated by the forest conservation plan and/or approved plans; those remaining shall be protected to preserve their aesthetic and erosion control values. Temporary on-site structures and buildings shall be located to preserve the existing landscape and to minimize erosion, including that from construction traffic. If practicable, work shall be scheduled in seasons when erosion is less of a hazard, particularly for sites with steep slopes and erodible soils.

Temporary protection shall be required for disturbed areas until final grading is completed and permanent vegetation is established and shall consist of planting temporary grass cover or other vegetation when feasible. Other short-term protection shall include covering disturbed areas, stockpiles and topsoil piles with a mulch of hay, straw or wood chips, stabilizing with netting, or covering with plastic sheets. Graded slopes and fills shall be limited to an angle and to lengths that will maintain stability and allow easy maintenance. Construction equipment shall not be operated in a way to make the land more susceptible to erosion, such as leaving tracks up and down slopes. Access roads shall be located and constructed so as to prevent erosion.

Controls for surface water runoff shall be constructed as early as possible to prevent the formation of gullies or rills. These controls shall be maintained during the entire construction period or until permanent storm drains/revetments are completed. Diversion channels or berms, slope drains, flow barriers, dikes or other structures, which retard or spread water flow, shall control runoff. Compacted embankments, ditches, furrows or temporary diversions across slopes shall be provided to intercept runoff before it reaches erodible areas. Diversions and drains shall be directed into stabilized areas where the discharge can be spread out and dissipated.

If unusually intense storms cause planned control measures to fail prompt restoration and cleanup of sediment deposits shall be made, including damage to adjacent property. If construction is delayed or shut down, temporary cover of exposed and disturbed areas shall be provided.

All Sediment and Erosion Control shall be incidental to the contract. No payment shall be made for maintenance or removal of sediment control measures.

FOREST AND TREE CONSERVATION REQUIREMENTS

The Contractor shall complete all forest and tree conservation requirements according to the approved contract documents:

- All forestry related work shall be under the direct supervision of someone who is both certified by the International Society of Arboriculture and registered in the State of Maryland as Licensed Tree Expert. Provide proof of both prior to on-site Forestry pre-construction meeting.
- Promptly replace any existing trees designated to remain that are damaged or destroyed in the course of development.

Special attention must be given the existing landscape features and special care taken to protect the natural surroundings. The roots of such trees or shrubbery will not be cut unnecessarily. The Contractor will be required to root prune the tree roots, which extend into grading limits and/or from trees intended to be left in an undamaged state or otherwise prevent damage to roots of trees. No road machinery of any description, which might throw off gas or smoke in such volume as to damage vegetation, shall be allowed to stand under such trees or shrubbery.

Any tree that in the opinion of the City, may be defaced, bruised, injured or otherwise damaged by the Contractor's equipment or operations must be protected prior to the start of work by means acceptable to the City. Contractor must verify all saved trees prior to construction. Prior to commencing construction, all tree protection techniques must be approved.

Any tree, or landscape features scarred or damaged by the Contractor's operations must be removed, correctively pruned, restored or replaced as nearly as possible to the original conditions, as required by the Project Inspector and at the Contractor's expense. No ropes, cables or guys are to be fastened to or attached to any nearby trees for anchorage or in lieu of placing of dead men.

CARE OF WATER DURING CONSTRUCTION

The Contractor shall furnish, install, test, operate, monitor, and maintain dewatering systems of sufficient scope, size, and capacity to control water flow into excavations and permit construction to proceed on dry, stable sub-grades. Dewatering operations shall be maintained to ensure erosion control, stability of excavations and constructed slopes, prevent excavation from flooding, and prevent damage to sub-grades and permanent structures.

The Contractor shall provide a suitable watercourse (i.e. fire hose, etc.) to direct the flow of water so as to have minimal impact upon the environment, private property, roadway and pedestrian traffic. Any damage caused by discharge of water is the responsibility of the Contractor. The Contractor shall not discharge any water so as to cause sediment to reach any storm drain inlet or water course.

The Contractor shall provide shoring, bracing and cofferdams during construction as necessary to protect personnel, structures and equipment. No special payment will be made for shoring, bracing or cofferdams. The Contractor is responsible for ensuring the safety of his employees and sub-contractors, and for complying with all applicable provisions of Maryland Occupational Safety and Health Administration.

The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations. The Contractor shall provide an adequate system to lower and control water to permit excavation, construction of structures, and placement of fill materials on dry sub-grades. The Contractor shall install sufficient dewatering equipment to drain water-bearing strata above and below bottom of ponds and other excavations.

Work areas shall be dewatered in a manner that avoids endangering public health, property, and portions of work under construction or completed. The Contractor shall provide sumps, sedimentation tanks, dewatering basins or non-woven dewatering bags as required by the Project Inspector. Standby equipment shall be provided on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of the system becomes inadequate or fails. If dewatering

requirements are not satisfied due to inadequacy or failure of dewatering system, the Contractor shall restore damaged structures and foundation soils at no additional expense to the City. The Contractor shall remove all dewatering systems from project site on completion of dewatering.

All pumps and generators utilized for bypass and dewatering operations shall be "quiet" rated with a full-load noise level of less than 63 dB at a distance of 23-feet or as approved by the Chief of Construction Management. The City may require additional measures, such as the use of straw bale baffle walls, for work approved outside of normal working hours.

Care of water during construction shall be considered incidental to the appropriate pay item.

DAILY CLEAN-UP

The Contractor shall at all times keep the work areas clean and orderly and shall promptly remove all waste and rubbish. The daily debris shall be collected in covered containers and disposed of in proper fashion. All directions from authorized public officials having jurisdiction over health and safety shall be obeyed. The site will be "broom cleaned" at the end of each working shift. Open excavations may not be left unattended. Site must be secured each night.

The Contractor shall clean every street upon which any work has been performed under this contract on a daily basis. The cleanup shall be accomplished by use of a vacuum assisted sweeper truck, manual (push) broom sweeping or other method as directed and or approved by the Project Inspector. Under no circumstance shall the contractor use compressed air or jet water sprays for cleanup purposes.

SAMPLING AND TESTING OF MATERIALS

Unless provided elsewhere in the contract documents, all required sampling and material testing shall be the responsibility of the Contractor. No separate payment will be made, and the costs shall be incidental to the appropriate pay item.

The City reserves the right to test all materials and construction separate from and in addition to the specific requirements dictated in this contract. Testing shall be generally limited to:

- Taking and/or collecting samples of soil and/or other backfill materials for proctor tests;
- Performing proctor tests in a lab;
- Performing compaction tests on site;
- Taking concrete cylinder samples and testing compression strength;
- Asphalt sampling and compaction testing.

Employment of a testing agency in no way relieves the Contractor of his responsibility and obligation to comply with all aspects of this contract and to perform all work in a proper, acceptable and workman like manner and doing all such work in full compliance with these contract documents.

SAMPLING AND TESTING OF ASPHALT MATERIALS

A Maryland State Highway (SHA) Certified Asphalt Plant must provide all asphalt supplied for this contract. Mix designs for the various types of material to be supplied must be submitted to the Project Inspector a minimum of 14 calendar days before beginning work. Under no circumstances will the contractor be allowed to begin supplying asphalt for this contract without the City and the Contractor having received written approval of the mix designs from the City or the City's Asphalt Testing

Consultant. The Contractor shall deliver to the City Project Inspector, a box sample of the material to be supplied, each day prior to lay down operations beginning. Any material laid down without having a box sample delivered to the City Project Inspector, will be subject to complete removal and replacement at the Contractors expense. Any box sample failing testing by the City's Asphalt Testing Consultant will cause that days placed asphalt to be completely removed and replaced at the Contractors expense.

SUBMITTALS OF MATERIALS:

The Contractor shall submit two (2) copies of all delivery tickets, shop drawings, inspection, testing or certification reports, obtained approvals or permits, and other submittals required for this project to the Chief of Construction Management.

INSPECTION AND CERTIFICATION:

All materials shall be subject to inspection or test by the City prior to installation and no previous certification or inspection shall bar rejection if the material is found to be inferior, damaged or defective. The certification requirements may be waived for any or all of the materials at the discretion of the City.

INSPECTION AND REPAIRS

The City reserves the right to inspect any and all work either in progress or completed. All work shall be inspected prior to backfill. Any portion of the work that is backfilled prior to inspection shall be uncovered at the contractor's expense to enable the Project Inspector to adequately inspect. If the work is found to be unsatisfactory or in conflict with the provisions in these specifications the City may hold back payment for work completed. The Chief, Construction Management, DPW will give written notification of the unsatisfactory work to the contractor. The Contractor shall have no more than 10 days to correct the condition.

CONTRACTOR'S EMPLOYEES

Contractor's employees are to present a professional appearance, shall be neat, clean, well groomed, courteous, and conduct themselves in a respectable manner while performing duties and while on City and/or private property.

The Contractor's employees shall conduct themselves in a professional manner. They shall minimize their impacts to the surrounding properties, including when they arrive to the site, take breaks, eat lunch and depart the site. Contractor's employees shall be respectful and polite to inquiries from residents or individuals not associated with the project. Any inquiries beyond basic information should be referred to the City. The Contractor shall inform the City of any inquiries that occur that is beyond providing basic information.

The Contractor shall provide the City with a listing of all personnel assigned to the contract. In addition, the Contractor shall provide a listing of names, and emergency telephone numbers of supervisory personnel assigned to the contract. It will be the Contractor's responsibility to keep this list up to date.

The City reserves the right to request that the contractor remove any employee if it is determined that services are not being performed in accordance with the terms and conditions of the contract.

SUB-CONTRACTORS

The Contractor shall have the right to sub-contract but shall be fully responsible and cannot be relieved of any liability under this contract on account of any sub-contractor. All sub-contracting must have prior written City approval. The City reserves the right to approve or reject any sub-contractor.

Nothing contained in the contract documents shall create any contractual relationship between the owner and any subcontractor or sub-subcontractor. Vendors who will subcontract the delivery, installation, or any other portion of the work herein described will submit, prior to construction, the following information:
A description of the items to be subcontracted, and the subcontractor's name, address, and telephone number. During the life of the contract, the Contractor shall provide the name, nature, and extent of all subcontractors.

Subcontractors shall be considered an agent of the Contractor, who shall be held fully accountable for all of the subcontractor services, labor, and materials relative to the contract.

CHANGES IN WORK

If an event arises which the contractor considers may result in the addition, deletion or modification to the contract, the Contractor shall notify the City prior to commencing work under that change.

All such changes, or additional work must be authorized in writing by the City prior to starting such work.

INVOICES AND PAYMENT

The Contractor shall submit a detailed invoice to the Chief, Construction Management Division, DPW for payment at the end of each month for all work completed and accepted by the City during that month. The Contractor shall attach to each monthly invoice, all required documentation of testing results.

TECHNICAL CONTACT/PROJECT MANAGER

Matthew Brew, Principal Civil Engineer
Rockville City Hall
Department of Public Works
111 Maryland Avenue
Rockville, MD 20850
Telephone 240-314-8516
Email: mbrew@rockvillemd.gov

City of Rockville
Rockville, Maryland

ROCKVILLE WATER TREATMENT PLANT IMPROVEMENTS: BULK SODIUM HYPOCHLORITE SYSTEM

BID-READY SPECIFICATIONS

City of Rockville
Rockville, Maryland

ROCKVILLE WATER TREATMENT PLANT IMPROVEMENTS: BULK SODIUM HYPOCHLORITE SYSTEM

100 PERCENT SPECIFICATIONS

CIVIL/PROCESS

SPECIFICATION DIVISONS 01- 02,05,07-11,33

PROFESSIONAL CERTIFICATION:
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland, License No. 24791,

Expiration Date: 02/28/24

Brian C. Aylaian, PE
NAME

City of Rockville
Rockville, Maryland

ROCKVILLE WATER TREATMENT PLANT IMPROVEMENTS: BULK SODIUM HYPOCHLORITE SYSTEM

100 PERCENT SPECIFICATIONS

STRUCTURAL

SPECIFICATION DIVISONS 03 - 04

PROFESSIONAL CERTIFICATION:
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland, License No. 39546,

Expiration Date: 10/12/2022

Lowry J. Denty, PE
NAME

Digitally signed by Lowry J Denty
Date: 2022.05.17 13:04:53-05'00'

STATE OF MARYLAND
LOWRY J. DENTY
No. 39546
PROFESSIONAL ENGINEER

City of Rockville
Rockville, Maryland

ROCKVILLE WATER TREATMENT PLANT IMPROVEMENTS: BULK SODIUM HYPOCHLORITE SYSTEM

100 PERCENT SPECIFICATIONS

MECHANICAL/PLUMBING

SPECIFICATION DIVISONS 21 - 23

PROFESSIONAL CERTIFICATION:
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland, License No. 55788,

Expiration Date: 03/12/24

Michael V. LaPilusa, PE
NAME

STATE OF MARYLAND
MICHAEL V. LAPILUSA
55788
PROFESSIONAL ENGINEER

Michael LaPilusa
C=US,
E=michael.lapilusa@mottmac.com,
O=Mott MacDonald, OU=EAI-FAF,
CN=Michael LaPilusa
Iselin, NJ
I have reviewed this document
2022.05.13 10:51:40-04'00'

City of Rockville
Rockville, Maryland

ROCKVILLE WATER TREATMENT PLANT IMPROVEMENTS: BULK SODIUM HYPOCHLORITE SYSTEM

100 PERCENT SPECIFICATIONS

ELECTRICAL

SPECIFICATION DIVISON 26

Digitally signed by Andrew Gibbs
Date: 2022.06.03 15:30:05 -05'00'

PROFESSIONAL CERTIFICATION:
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed Professional Engineer under the laws of the State of Maryland, License No. 45164,

Expiration Date: 03/09/24

Andrew K Gibbs, PE
NAME

TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

DIVISION 25 - INTEGRATED AUTOMATION

Not Used

DIVISION 26 - ELECTRICAL

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

Not Used

DIVISION 31 - EARTHWORK

Not Used

DIVISION 32 - EXTERIOR IMPROVEMENTS

Not Used

END OF DOCUMENT

SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and Drawing conventions.

1.03 PROJECT INFORMATION

A. Project Identification: Rockville Water Treatment Plant Improvements: Bulk Sodium Hypochlorite System.

a. Project Location: Rockville Water Treatment Plant, 10930 Sandy Landing Road, Potomac, MD.

B. City: City of Rockville.

C. Engineer: Mott MacDonald, 225 International Circle, Hunt Valley, MD 21030.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

A. All demolition and disposal work shall be in accordance with all rules, regulations and requirements of the board of health, MDE and all other local and state agencies having jurisdiction.

1. Demolition of the existing monorail, chlorine room interior equipment, including removal of the sodium hypochlorite cylinders, and indicated HVAC, electrical, plumbing, and structural demolition.

2. Renovation of the existing chemical building chlorine room to house and operate a new liquid-feed sodium hypochlorite including bulk tanks, day tanks, transfer and metering pumps.

3. Setup of a temporary chlorine feed system during construction of the chemical building renovations.

4. Upgrades to the HVAC, plumbing and fire protection associated with the renovations of the chlorine room.

5. Structural changes to the chlorine room including new double doors and a knockout wall on the exterior, and containment wall and sump pit in the interior.

6. Electrical distribution system equipment improvements.

7. New outdoor concrete slab.

8. Other Work indicated in the contract documents including specifications and drawings.

B. Type of contract:

1. Project will be constructed under a single prime contract

1.05 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to City, City 's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.06 COORDINATION WITH OCCUPANTS

A. Full City Occupancy: City will occupy site and existing and adjacent building(s) during entire construction period. Cooperate with City during construction operations to minimize conflicts and facilitate City usage. Perform the Work so as not to interfere with City's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from City and approval of authorities having jurisdiction.

2. Notify City not less than 72 hours in advance of activities that will affect City's operations.

B. City Limited Occupancy of Completed Areas of Construction: City reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to City acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited City occupancy.

3. Before limited City occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, City will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. On occupancy, City will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.07 WORK RESTRICTIONS

A. The WTP operation shall remain undisturbed throughout the construction activities. The Contractor shall submit construction phasing and sequencing plan to Engineer and City for approval prior to the start of construction activities.

B. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

C. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by City or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Engineer and City not less than 72 hours in advance of proposed utility interruptions.

2. Obtain City 's written permission before proceeding with utility interruptions.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to City occupancy with City.

1. Notify Engineer and City not less than 72 hours in advance of proposed disruptive operations.

2. Obtain City 's written permission before proceeding with disruptive operations.

F. Restricted Substances: Use of tobacco products and other controlled substances within the existing building and project site except designated areas is not permitted.

G. Employee Identification: City will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with City's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with City's representative.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Contingency allowances.
5. Testing and inspecting allowances.

1.03 DEFINITIONS

A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.04 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer and City of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the City to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer and City from the designated supplier.

1.05 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.06 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.07 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by City or selected by Engineer under allowance and shall include taxes**,** freight and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by City or selected by Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to City, after installation has been completed and accepted.

1. If requested by Engineer, retain and prepare unused material for storage by City. Deliver unused material to City's storage space as directed.

1.08 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Engineer for City's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by City under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to City by Change Order.

1.09 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of testing and inspection services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to City by Change Order.

1.010 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. City reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower- priced materials or systems of the same scope and nature as originally indicated.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Cost Allowance: Include $50,000 for hazardous materials abatement work including removal and disposal of any identified materials from the water treatment plant, as specified in Section 02 11 00 "Hazardous Material Remediation."

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS

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

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

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

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

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Outdoor concrete pad restoration

1. Base Bid: All work with the exception of the restoration of the outdoor concrete cylinder pad is included in the base bid.
2. Alternate: All work including the restoration of the outdoor concrete cylinder pad.

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 23 00 "Alternates" for products selected under an alternate.

1.03 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or City that are not required in order to meet other Project requirements but may offer advantage to Contractor or City.

1.04 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.

b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by City and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of Engineers and City.

h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from Montgomery County.

j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.06 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.07 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with

these requirements:

a. Requested substitution offers City a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities City must assume. City's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by City, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 01 23 00 “Alternates” for procedural requirements governing the handling and processing of alternates.
2. Section 01 25 00 “Substitution Procedures” for procedural requirements governing the handling and processing of substitution.
3. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Engineer at earliest possible date, but no later than ten days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line

items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Engineer.
    c. Engineer's Project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange schedule of values consistent with format of EJCDC Document C-620.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one- hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Alternates: Provide a separate line item in the schedule of values for each alternate. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.

9. Closeout Costs: Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
10. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by City.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between City and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. Submit draft copy of Application for Payment twenty days prior to due date for review by Engineer.

C. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor shall be acceptable to Engineer and City. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under City-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.

1. Provide certificate of insurance, evidence of transfer of title to City, and consent

of surety to payment.

2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Maintain an updated set of drawings to be used as record drawings in accordance with Section 01 78 39 “Project Record Documents”. As a prerequisite for monthly progress payments, exhibit the updated record drawings for review by City and Engineer for completeness and accuracy.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule.
4. Products list (preliminary if not final).
5. Submittal schedule.
6. List of Contractor's staff assignments.
7. Copies of building permits.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Report of preconstruction conference.

I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete

and a statement showing an accounting of changes to the Contract Sum.

2. Include initial submittal of closeout record drawings in accordance with Section 01 78 39 “Project Record Documents”.
3. This application shall reflect Certificate(s) of Substantial Completion issued previously for City occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Final submittal of closeout record drawings in accordance with Section 017839.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when City took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

A. RFI: Request for Information. Request from City, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and in prominent location in built facility. Keep list current at all times.

1.05 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for City and separate contractors if coordination of their Work is required.

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.06 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    e. Indicate required installation sequences.
    f. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
3. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
5. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.

6. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire- alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor- control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

7. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

8. Review: Engineer will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
9. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."

1.07 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.

5. Name of Engineer.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Engineer's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project software. Include the following:

1. Project name.
2. Name and address of Contractor.

3. Name and address of Engineer.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Engineer's response was received.
8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

E. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.

1.08 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion. General Contractor shall be responsible for the full cost for the project team including costs for City, Engineer, Contractor, subcontractors and suppliers.

1. Web-based Project software site includes, at a minimum, the following features:

   a. Compilation of Project data, including Contractor, subcontractors, Engineer, architect's consultants, City, and other entities involved in Project. Include names of individuals and contact information.
   b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
   c. Document workflow planning, allowing customization of workflow between project entities.
   d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
   e. Track status of each Project communication in real time, and log time and date when responses are provided.
   f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
   g. Processing and tracking of payment applications.
   h. Processing and tracking of contract modifications.
   i. Creating and distributing meeting minutes.
   j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
   k. Management of construction progress photographs.
   l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to five web-based Project software user licenses for use of City,

Engineer, and Engineer's consultants.

3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Engineer. Provide data in locked format to prevent further changes.
4. Provide one of the following web-based Project software packages under their current published licensing agreements:

    a. Autodesk.
    b. Corecon Technologies, Inc.
    c. Meridian Systems; Prolog.
    d. Newforma, Inc.
    e. Procore Technologies, Inc.
    f. Viewpoint, Inc.; Viewpoint for Project Collaboration.

B. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.09 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify City and Engineer of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including City and Engineer, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to City and Engineer, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of City Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

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

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Sustainable design requirements.
    o. Preparation of Record Documents.
    p. Use of the premises and existing building.
    q. Work restrictions.
    r. Working hours.
    s. City's occupancy requirements.
    t. Responsibility for temporary facilities and controls.
    u. Procedures for moisture and mold control.
    v. Procedures for disruptions and shutdowns.
    w. Construction waste management and recycling.
    x. Parking availability.
    y. Office, work, and storage areas.
    z. Equipment deliveries and priorities.
    aa. First aid.
    bb. Security.
    cc. Progress cleaning.
    dd. List of major subcontractors and suppliers.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to City and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of City, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for completing sustainable design documentation.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Procedures for processing Applications for Payment at Substantial Completion and for final payment including final change order.
k. Submittal procedures.
l. Coordination of separate contracts.
m. City's partial occupancy requirements including certificate of occupancy and closeout of permits.
n. Installation of City's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.
p. Final cleaning.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

D. Progress Meetings: Conduct progress meetings at monthly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of City and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the

following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site use.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of Proposal Requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 01 33 00 “Submittal Procedures”

2. Section 01 31 00 "Project Management and Coordination.

3. Section 01 29 00 “Payment Procedures”

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

1.04 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Reports: Submit at monthly intervals.

E. Material Location Reports: Submit at monthly intervals.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Unusual Event Reports: Submit at time of unusual event.

H. Qualification Data: For scheduling consultant.

1.05 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, interim milestones and partial City occupancy.
4. Review delivery dates for City-furnished products.
5. Review schedule for work of City's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and City startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.
12. Submit at this conference a preliminary network defining the planned operation during the first 60 calendar days after the Notice to Proceed.

1.06 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.07 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Primavera for scheduling component of Project website software specified in Section 01 31 00 "Project Management and Coordination" for current Windows operating system.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

    a. Sodium Hypochlorite Storage Tanks
    b. Sodium Hypochlorite Feed System
    c. Unit Heaters
    d. Chlorine Room HVAC System

3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures

necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work Restrictions: Show the effect of the following items on the schedule:

    a. Limitations of continued occupancies.
    b. Uninterruptible services.
    c. Partial occupancy before Substantial Completion.
    d. Use-of-premises restrictions.
    e. Seasonal variations.
    f. Environmental control.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Completion of electrical installation on the 3rd Floor.
    b. Completion of the 2nd Floor renovation.
    c. Completion of building mechanical installation.
    d. Completion of site electrical work.
    e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

H. Acceptability

1. The Engineer's review of the Contractor's construction schedule submittals will only be for conformance with the Contract requirements – including but not limited to contract time and work sequences specified in the contract documents. The Engineer's review of the schedule shall not include the Contractor's means and methods of construction or safety. The Engineer 's concurrence, acceptance, or approval of the Contractor's schedule submittals will not relieve the Contractor from responsibility for complying with the Contract Scope, Contract Time or any other contract requirement. Any indication of concurrence, acceptance, or approval of the Contractor's schedule will only indicate a general conformance with the Contract Requirements.
2. Engineer's review of the Contractor's construction schedule submittals shall not relieve the Contractor from responsibility for any deviations from the Contract Documents unless the Contractor has in writing called Engineer's attention to such deviations at the time of submission and Engineer has given written concurrence to the specific deviations, nor shall any concurrence by the Engineer relieve Contractor from responsibility for errors and omissions in the submittals. Concurrence of the schedule by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the Work within the Contract completion date(s).
3. Concurrence, acceptance, or approval of the Contractor's schedule by the Engineer in no way makes the Engineer an insurer of the schedule's success, nor liable for time or cost overruns resulting therefrom.
4. Failure to include any element of work required for the performance of this Contract will not excuse the Contractor from completing all Work required within the Contract completion date(s), notwithstanding the review of the network by the Engineer.

5. A Critical Path Method (CPM) construction schedule shall be used to control the work of this Contract and to provide the definitive basis for determining job progress.
6. Except where earlier completions are specified, schedules which show completion of all work prior to the contract completion date may be indicated; however, in no event shall they constitute a basis for claim for delay by the Contractor.

I. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity. Activities shall not be considered to be complete until they are in fact 100 percent complete.
4. Submit a narrative report based on the schedule evaluation, in a format agreed upon by the Contractor and the Engineer. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each

   activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed.

J. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

K. The contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, the Contractor shall furnish such justification and supporting evidence as the Engineer may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any contract completion date, the Engineer’s determination as to the total number of days extension shall be based upon the currently approved schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities which, according to the schedule, do not affect any

contract completion date shown by the critical path in the network will not be the basis for a change therein.

L. Distribution: Distribute copies of approved schedule to Engineer City, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.08 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.09 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.

12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Work Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise City in advance when these events are known or predictable.

1. Submit unusual event reports directly to City within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of City's personnel.

1.03 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based project software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web- based project software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Engineer.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.04 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.05 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, project area and sequential numbering suffix.

E. Usage Rights

1. Obtain and transfer copyright usage rights from photographer to City for unlimited re- production of photographic documentation.

1.06 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Engineer.

1. Flag construction limits before taking construction photographs.
2. Take minimum 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take minimum 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of

adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Engineer will inform photographer of desired vantage points.

F. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. City's request for special publicity photographs.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
5. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of City's personnel.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

C. Mass Submittals: Six or more submittals or items in one day or 15 or more submittals or items in one week.

1.04 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

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

3. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Engineer's final release or approval.

1.05 SUBMITTAL FORMATS

A. Numbering System: Utilize the following example submittal identification numbering system to identify submittals and as file names for PDF submissions:

1. First Identifier - Alphabet Character: D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operating & Maintenance) or Informational, respectively.
2. Second Identifier - Next 6 or 8 Digits: Applicable Specification Section Number. Do not mix submittals from different specification sections into a single submittal.
3. Third Identifier - Next Three Digits: Sequential number of each separate item or

drawing submitted under each Specification Section, in chronological order submitted, starting at 001.

4. Fourth Identifier - Last Alphabet Character: A to Z, indicating the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc.
5. EXAMPLE: D-033000.13-008-B.

    a. D = Shop Drawing.
    b. 03 30 00.13 = Section; use only 6 digits for sections that do not include 8 digits.
    c. 008 = the eighth different submittal under this Section.
    d. B = the second submission (first resubmission) of that particular shop drawing.

B. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Engineer.
4. Retain first subparagraph below if a construction manager has been retained for Project.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

C. Options: Identify options requiring selection by Engineer.

D. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

E. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.06 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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

1. Initial Review: Allow 15 days for initial review of each submittal (and 30 days for multi- discipline reviews). Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
4. Repetitive Reviews: Shop drawings, O&M manuals, and other submittals will be reviewed no more than twice at the City's expense. All subsequent reviews will be performed at the Contractor's expense. Reimburse the City for all costs invoiced by Engineer for the third and subsequent reviews.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

1.07 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with

Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality- control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as City's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of

units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and Citys, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Contractor’s Certification: Each shop drawing, working drawing, product data, and sample shall have affixed to it the following Certification Statement:

a. "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements. "

3. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
4. Manufacturer Certificates: Submit written statements on manufacturer's letterhead

certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

5. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
6. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
7. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.08 MANUFACTURERS' FIELD SERVICES AND CERTIFICATES OF PROPER INSTALLATION

1 When specified in Contract Documents, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, test, adjust, and start-up of equipment, and to initiate instructions when necessary.

2 Provide certificate stating that the equipment or system has been installed in accordance with the manufacturer's recommendation and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, and that the proper electrical and mechanical connections have been made.

3 Submit report within 30 days of observation to Engineer for review.

1.09 DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.010 PROPOSED PRODUCT LIST

A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.011 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Contractor Responsible for:

1. Determination and verification of materials including manufacturer's catalog numbers.
2. Determination and verification of field measurements and field construction criteria.
3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
4. Determination of accuracy and completeness of dimensions and quantities.
5. Confirmation and coordination of dimensions and field conditions at Site.
6. Construction means, techniques, sequences, and procedures.
7. Safety precautions.
8. Coordination and performance of Work of all trades.
9. Other requirements enumerated in Contract Documents.

C. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web- based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.012 ENGINEER'S REVIEW

A. Do not make mass submittals to Engineer. If mass submittals are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review mass submittals based on priority determined by Engineer after consultation with City and Contractor.

B. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required.

1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.
2. Submittals by Web-Based Project Software: Engineer will indicate, on Project software website, the appropriate action.

C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

F. Engineer will return without review submittals received from sources other than Contractor.

G. Submittals not required by the Contract Documents will be returned by Engineer without action.

H. Shop drawings will be returned to the Contractor with one of the following codes.

1. "NO EXCEPTIONS TAKEN" - This code is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
2. "MAKE CORRECTIONS AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
3. "REVISE AND RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. The resubmittal is to address all comments, omissions and non-conforming items that were noted. An additional box is checked to indicate whether the resubmission is for the complete package, or for parts of the package. If no box is checked, a complete resubmittal shall be provided. Review code may designate if a partial or full submittal is required. If full submittal is required, a complete resubmittal package addressing all comments shall be provided. If a partial submittal is designated, resubmittal shall only include information pertaining to those items noted in review comments requiring clarification and any portions of submittal impacted as a result of the response. Resubmittal is to be received by the Engineer within 30 calendar days of the date of the Engineer's transmittal requiring the resubmittal.
4. "REJECTED" - This code is assigned when the submittal does not meet the intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the Contract Documents.
5. "RECEIPT ACKNOWLEDGED (Not subject to Engineer's Approval)" - This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer's approval. This code is generally used with submittals involving the Contractor’s means and methods of construction work plans, and health and

safety plans.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes special procedures for alteration work.

1.03 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Disassembly: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

D. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Engineer.

E. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

F. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

G. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

H. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

I. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

J. Retain: To keep existing items that are not to be removed or dismantled.

K. Strip: To remove existing finish down to base material unless otherwise indicated.

1.04 MATERIALS CITYSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to City that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain City's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to City where directed by the City.

1.05 INFORMATIONAL SUBMITTALS

A. Fire-Prevention Plan: Submit 30 days before work begins.

1.06 QUALITY ASSURANCE

A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with City's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.07 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to City.
4. Transport items to City's storage area designated by City.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Engineer, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.

E. Storage Space:

1. City will arrange for limited on-site location(s) for free storage of salvaged material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.08 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs.

1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."

B. Discrepancies: Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. City's Removals: Before beginning alteration work, verify in correspondence with City that all items remaining on the 2nd and 3rd floors are to be removed and disposed.

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify City, Engineer, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Engineer immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.02 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with

heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain City's approval for operations involving use of welding or other high-heat equipment. Notify City at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B and NFPA 241.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire- extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.03 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off City's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.04 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 01 32 33 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Engineer of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Engineer.

END OF SECTION

SECTION 01 40 00
CONTINUITY OF PLANT OPERATIONS AND WORK SEQUENCE

PART 1 - GENERAL

1.01 INTENT OF SECTION

A. The following description of the work sequence, as it relates to continuity of plant operations, provides a suggested approach to implement the work while minimizing interruptions of the City's operation. The City understands that implementation of the work may require some down time for portions of the plant. Nevertheless, interruptions must be scheduled with the City to permit alternative modes of operation and maintain continuous water service.

B. The following outline identifies the areas of work that may restrict plant operations and allows the City and Contractor to negotiate the permissible down time for specific plant functions and suggest other provisions for continuous or partial operation.

1.02 WORK PLAN

A. Submit a written work plan, prior to performing each phase of the work, to give the City and Engineer assurance that the work has been planned to minimize interruptions. The work plan also provides the opportunity for the City and Engineer to review assumptions regarding interruptions of the City's operation. The work plan shall provide sufficient flexibility to accommodate changes requested by the City and Engineer to minimize the interruptions.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Shutdowns may be permitted during regular business hours, Monday through Thursday, or during premium business hours, based on criteria provided for each individual shutdown. The City may require major shutdowns requested for non-premium period to be performed during premium periods due to reasonable concerns. City shall provide a written denial to Contractor, and Contractor shall reschedule the shutdown to premium periods. The City shall have the right to require up to two (2) requested non-premium shutdowns to be performed during premium periods, at no additional cost to the City. Premium costs of subsequent denials shall be reimbursable as a change order.

B. A chlorine feed system shall be in continuous operation through the duration of all project work with no exceptions.

3.02 NOTIFICATIONS

A. The Contractor shall provide a written "Notice of Intention" a minimum of seven (7) calendar days prior to major shutdowns, and a minimum of fourteen (14) days prior to critical shutdowns. Notices shall include a copy of the final approved work plan. Also, the on-site plant supervisor shall be alerted in writing of the Contractor's "Intent to commence shutdown" 24-hours prior to any shutdown. This shall be in addition to previous "Notice of Intention."

3.03 SUGGESTED SEQUENCE

A. The sequence outlined below for the listed work items are critical to maintaining maintenance of plant operations during construction and shall be incorporated into the Contractor's overall work plan. Other work items, shown within the contract documents, which are not listed below are not considered critical to the work sequence but should also be shown in the Contractor's work plan.

B. Plant operations and the disinfection feed system shall remain in operation at all times during construction. A temporary feed system shall be installed, tested and approved by the City prior to the start of any demolition. Refer to the preferred location of the temporary disinfection system on the Contract Drawings.

C. Removal of the chlorine gas cylinders and associated equipment from the Chlorine Room can begin after the temporary disinfection is in place. After removal of the cylinders to a truck for disposal offsite, removal and salvage of the existing hoist system can commence. After turnover of the hoist to the City, demolition can commence upon approval of the demolition plan. During demolition the Contractor shall protect the Chorine Room from outside weather conditions.

D. After demolition and approval of work plans, architectural and structural work in the Chlorine Room and outside storage pad can commence. The outside wall of the Chlorine Room cannot be constructed until the Sodium Hypochlorite Tanks are installed, tested and approved by the City.

E. Mechanical work can commence after the tanks are in place and the balance of the architectural and structural work is completed. Electrical work can commence after completion of the mechanical work. Instrumentation, controls and PLC programming can commence after the electrical work is completed.

F. Once all individual project components are installed, certified by the manufacturers and tested to the satisfaction of the City, sodium hypochlorite feed system performance testing can begin. The temporary disinfection system cannot be decommissioned and removed until the new system has passed the performance test and commission period.

G. Removal of the temporary disinfection system can commence after satisfactory performance testing, then final restoration, cleanup and closeout can proceed.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 WATER SUPPLY

A. ***Contractor must supply their own water. Water is not available for construction purposes.*** In addition to supplying water, all necessary meters, temporary piping and valves in connection with such water supply shall be furnished and installed by the Contractor.

1.02 TEMPORARY HEAT

A. Provide approved type heating apparatus with the necessary fuel in order to protect and/or dry out the work. The stored materials and finished work shall be protected at all times from damage by the weather elements.

1.03 ELECTRICAL SUPPLY

A. Obtain necessary permits, pay all fees, and have meter installed for power and light as may be required.

1.04 TEMPORARY LIGHTING

A. Provide and maintain incandescent lighting for construction operations and lighting to exterior staging and storage areas after dark for security purposes.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing buildings. Provide protection for plant life designated to remain. Replace damaged plant life.

1.06 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Designate one parking space each for the City, Engineer, and Resident Project Representative.

1.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust. Remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.09 SANITARY FACILITIES

A. Provide suitable temporary facilities and enclosures for the use of workmen and shall maintain same in a sanitary condition.

B. Be advised that the City is in the business of providing potable water and the Contractor's sanitary arrangements shall not endanger the City's facilities.

1.10 FIELD OFFICES

A. Contractor can not use City’s facilities, offices, or restrooms.

B. Provide, at location designated or otherwise approved by the City, separate field office for the Contractor’s use. Unless otherwise approved, the Contractor’s field office shall be large enough, and furnished, to conduct progress meetings. The Contractor’s field office is to be an official place of business for the Contractor at which an authorized agent of the Contractor will be present while work is in progress. The record documents required to be maintained by the Contractor per Article 6.19 of the General Conditions shall be kept at the Contractor's field office.

C. For added security, the windows of the office shall have security bars or heavy gage steel wire mesh on the outside and all doors shall be fitted with hasps and padlocks. Install wooden stairs and platforms with handrail at each exterior door. Provide access walkways as required to each entrance. Trailers shall be leveled on blocks and furnished with tie-down straps and anchors. The contractor field office shall be appropriately furnished for the contractor to conduct business and progress meetings.

1.11 DUST CONTROL

A. Take all necessary measure to control dust from his operations, and to prevent spillage of excavated materials on public roads.

B. Remove all spillage of excavated materials, debris or dust from public roads by methods approved by the Engineer.

C. Sprinkle water at locations and in such quantities and at such frequencies as may be required by the Engineer to control dust and prevent it from becoming a nuisance to the surrounding area.

D. Dust control and cleaning measures shall be provided at no additional cost to the City.

1.12 USE OF PROJECT SITE

A. Construct and maintain suitable and safe crossings over trenches or provide detours as necessary to care for public and private traffic. Provide flagmen at junctions of public traffic and Contractor vehicles and equipment.

B. Access must be maintained at all times to allow continued chemical deliveries to the water treatment plant.

C. Access must be maintained at all times to allow continued sludge hauling (2 tanker trucks per day on average) at the water treatment plant.

1.13 PROJECT SIGN

A. Erect a sign at the Project site identifying the project. The sign shall be erected within twenty-one (21) days after the Notice to Proceed and shall be in accordance with the Specifications and details included in this Section. Furnish, erect and maintain the project sign and sign panel at the location designated by the Engineer. Wording and colors shall be identified by the Engineer.

B. Fabricate, erect and maintain the project sign in accordance with the following specifications:

1. Sign Panel: The sign panel shall be constructed of ¾ inch minimum thickness marine plywood rebated into a 2 inch by 4 inch wood frame. All fasteners used in the construction of the sign shall be of a rustproof nature.

2. Painting: All supports, trim and back of the sign panel shall be painted with at least two (2) coats of the same paint used for the sign face. All paint used shall be exterior grade paint, suitable for use on wood signs.

3. Sign Supports: The supports for the project sign shall be at least two 4 inch by 4 inch treated wood posts. The sign panel shall be securely fastened to the sign supports with at least six (6) 3/8" galvanized bolts, nuts and washers. The positioning and alignment of the sign shall be as determined by the Engineer.

4. Maintenance: Maintain the project sign, in good condition, at all times, for the duration of construction.

5. Removal of Sign from Project Site: Remove the project sign from the construction site at the completion of construction, when ordered by the Engineer.

6. Payment: The cost of the fabrication, erection, maintenance and removal of the project sign, including all labor and materials, shall be included in the Contractor's Lump Sum Bid. No extra payment will be made for obliterating certain names and offices and replacement thereof of others because of administrative changes during the course of this Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 53 29
TEMPORARY HYPOCHLORITE FACILITY

PART 1 – GENERAL

1.01 SUMMARY

A. Contractor shall provide a temporary hypochlorite facility to ensure uninterrupted chlorine feed to the pump station during demolition and construction of the new sodium hypochlorite facility. The temporary facility shall include a FRP modular building or skid-mounted trailer, temporary sodium hypochlorite (15%) storage of 5,000-gallons,a four (4) metering pump chemical feed skid, a duplex (2) transfer pump skid, one (1) 230-gallon double walled day tank, emergency shower/eyewash, mix water panels, hot water heater, instrumentation and controls, and interconnection piping for a complete and operational system.

B. Shelter constructed of fiberglass reinforced plastic (FRP) or be provided as a skid-mounted trailer. Shelter or trailer shall be delivered fully assembled with electrical and HVAC requirements included. If Contractor selects skid-mounted trailer, Contractor is responsible for weatherproofing, heat-tracing, sheltering from snow and operation during the winter months.

C. Tanks shall be double walled. If the storage tank is required to be placed outside due to size, the tank(s) shall be double walled with heat tracing and insulation. Outdoor tanks shall be secured and anchored as needed in accordance with Section 2.07.

D. Contractor is responsible for delivery and supply of 15% sodium hypochlorite, and operation of the temporary hypochlorite facility for its entire duration.

E. When the temporary hypochlorite facility is no longer needed in accordance with Section 2.11, the facility shall be disassembled as required and removed off-site by the Contractor, or as otherwise directed by the City. Components of the temporary system including but not limited to the pumps, tanks and ancillary equipment cannot be reused or relocated to the permanent hypochlorite facility.

1.02 REFERENCE

A. Submittals: Section 01 33 00 Submittal Procedures

B. Chemical Metering and Transfer Pumps: 11 24 40

C. Polyethylene Chemical Storage Tanks: Section 11 24 00

D. Plumbing Fixtures: Section 22 42 18

1.03 SUBMITTALS

A. Submit Shop Drawings and product data for all equipment supplied under this Section in accordance with the requirements of Specification Section 01 33 00 Submittal Procedures.

B. Submit Operation and Maintenance manuals for all equipment supplied under this Section in accordance with the Specification Section 01 33 00 Submittal Procedures.

C. Submit Manufacturer's Certificate for all equipment with testing and calibration requirements under this Section in accordance with the requirements of Specification Section 01 33 00 Submittal Procedures.

D. For the FRP Shelter, submit approval drawings showing dimensions, materials of construction, wiring diagram, HVAC load calculations, anchor bolt locations and size of fasteners.

E. Submit proposed layout of the equipment in the temporary hypochlorite facilities if it is modified from the plan showed in the contract documents.

F. Submit cut sheet indicating the shelter material compatibility with NaOCl and dimensions.

G. Submit plumbing schematic of the temporary facility, including backflow preventer, water line, emergency eyewash, as well as hot water tank with recirculation valve.

H. Submit P&ID drawing of the temporary facility.

1.04 QUALITY ASSURANCE

A. Component Coordination: Components of the instrumentation may be the products of different system Manufacturers or suppliers, however, to ensure that the instrumentation is properly coordinated, obtain the instrumentation system from one of the Manufacturers or authorized representatives of these Manufacturers, or system supplier.

1. Responsibility for satisfactory operation of the instrumentation is that of the System Supplier, who shall coordinate efforts of Sub-Manufacturers in satisfying supervisory service as required.
2. Provide products of Manufacturers' latest and proven design.
3. Document that the instrumentation provided is in accordance with ISA Standard ISA-S5.1-73.

B. Field Conditions: The equipment specified shall operate under specific field conditions. If the equipment/instrument fails to function properly under the specified conditions during the time the temporary hypochlorite facility is functional, it is the responsibility of the system Manufacturer (through the Contractor) to correct the problem at no additional cost to the City.

1.05 DELIVERY, STORAGE AND HANDLING

A. Follow Manufacturer's instructions.

B. Contractor is responsible for providing the appropriate quick-connect fill line length and/or configuration for sodium hypochlorite deliveries where truck access or space may be limited on-site.

1.06 WARRANTIES

A. Provide Manufacturer's Warranty as specified in Section 01 78 39 Project Record Documents.

B. If the fiberglass building is damaged by weather or vandalized while being used to house the temporary hypochlorite system, it is the contractor's responsibility to make any and all repairs with no additional cost to the City.

PART 2 – PRODUCTS

2.01 FRP SHELTER

A. Number of FRP Shelter: 1

2.02 CONSTRUCTION MATERIALS

A. Interior Finish

1. Interior Resin shall be white or light gray in color

2.03 RESIN

A. Polyester Resin

B. Filler and Additives

1. The use of filler or additives is not acceptable.
2. Thixotropic agents for viscosity control are acceptable.
3. Colorants which have been determined by at least five years previous service to be acceptable for the service condition are acceptable.
4. Catalysts, accelerators and/or promoters shall be added to provide complete cure of the laminate and must meet the physical properties as specified.

2.04 ENCAPSULATED EQUIPMENT MOUNTING BOARD

A. Sidewall panel is described as sandwich molded component made of solid fiberglass on the outside and inside with a solid 1” foam panel sandwiched between these fiberglass surfaces to meet load requirements.

B. Each side panel has a structural 3” internal flange with a minimum thickness and strength to meet load requirements.

C. Roof panel is a single molded component made of the same process as the side panels with built into the structural internal flanges. The flanges are used to obtain strength to meet load requirement. Each component must be 4’ in width and match sidewall panels. Length of roof panel varies depending on width of building

D. All roof panels must provide a positive drainage for water

E. End wall panels are modular sections that consist of a fiberglass outside surface and an internal fiberglass surface sandwiching 1” foam.

F. Each panel is also strengthened by rib stiffening throughout the panel. It shall be strong so that equipment can be mounted anywhere along the wall as required.

G. Each end panel has a structural 3” internal flange with a minimum thickness and strength

H. Components will have a minimum r value of R -10.

2.05 SHELTER SHALL MEET OR EXCEED THE FOLLOWING CONSTRUCTION REQUIREMENTS:

A. Shelter Walls and Roof

1. Shelter walls shall have a minimum of 1" of insulation in between 1/8" skins or injected in panels.
2. Shelter roof shall be fabricated by vacuum infusion or panel injection with 1.5" of insulation.
3. Shelter wall on all sides shall be suitably reinforced for equipment mounting, or shelving.
4. Shelter roof shall have a minimum of 3 inch overhang all sides.
5. The interior shall be white to maximize available lighting.
6. The FRP laminate shall be fiberglass reinforced plastic containing not less than 34% glass content by weight.
7. The exterior coat shall be pigmented for UV protection for all exterior surfaces for protection against weathering and discoloration.
8. The exterior surface finish color shall be white.

2.06 SHELTER SHALL MEET OR EXCEED THE FOLLOWING STRUCTURAL REQUIREMENTS:

A. Snow Load: 40 PSF (195 kg per sq meter)

B. Wind: 135 MPH (217 km per hr)

C. Insulation Factor: R-7

D. Shelter shall be NEMA 3R compliant

2.07 ANCHORING

A. Anchoring as required by calculation but not to exceed 2'-0" on center. Calculations shall be submitted to the Engineer for approval.

2.08 PHYSICAL REQUIREMENTS OF SHELTERS

A. All laminates shall meet the following minimum physical requirements:

	ASTM Test Method	Minimum Properties
Tensile Strength	D-638	14,000 psi
Flexural Strength	D-790	23,000 psi
Flexural Modulus	D-790	0.80 x 106 psi
Barcol Hardness	D-2583	30
Izod Notched Impact, ft. lbs/in.	D-256	10 ft. lbs./in.
Water Absorption (24 hours)	D-570	<.2% (in 24 hrs.)

B. The closed cell rigid insulating foam shall be dimensionally stable over the full range of operating temperatures and contain NO CFCs. Typical physical properties shall be:

Density	2 lbs/ft^3
Closed cell content	85 - 90%
Thermal conductivity	0.7 BTU • in/hr • ft^2 • °F ("k-factor")
Temperature range	-100°F to +225°F

C. Fiberglass reinforced plastic (FRP) laminate used to manufacture components must have an exterior surface that has min 20 mil orthopthalic polyester that is pigmented and with an added ultraviolet –9 stabilizer. When component has cured, the outside surface must be coated with Hectrolac 105 which is a lacquer containing ultraviolet absorber.

2.09 STANDARD INSTALLATION

A. Installation may be accomplished by bolting through the pre-drilled holes in the interior bolting flange to an existing floor pad, or other suitable flat surface, using ½" X 5-1/2" anchor bolts and heavy-duty washers min. 3 ½" x 3 ½" x ¼", unless required otherwise by calculation.

B. Sealing with neoprene base flange gasket or mastic caulk.

2.10 COMMISSIONING OF THE TEMPORARY SYSTEM

A. A temporary feed system shall be installed, tested and approved by the City prior to decommissioning the existing chlorine facility. The temporary system shall be tested for a period of no less than five (5) days of continuous operation.

B. Plant operations and the temporary feed system shall remain in operation at all times after the existing facility has been decommissioned.

2.11 DECOMMISSIONING OF THE TEMPORARY SYSTEM

A. The temporary feed system shall not be decommissioned and removed until the new permanent system has passed the performance test and commission period.

B. Contractor shall provide commissioning plan containing details and checklist items for transition from the temporary to the permanent facility. Commissioning plan shall be approved by the City prior to decommissioning of the temporary system.

2.12 ACCEPTABLE MANUFACTURERS

A. RM Products Ltd

B. Plasti-Fab Inc of Tualatin, OR

C. Engineered Fiberglass Composites (EFC)

D. Or Approved Equal

2.13 EYEWASH/SHOWER SYSTEM

A. FPR Shelters shall be furnished with OSHA compliant stainless steel combination eye/wash shower units. Coordinate floor drain location.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 65 00
TESTING AND COMMISSIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section covers testing requirements in accordance with the Specifications, as shown on the Drawings, and as necessary for a complete and satisfactory installation. Testing by the Contractor shall include equipment checkout, equipment and systems testing and startup, and equipment, systems, and plant commissioning. Equipment shall be considered for this specification as any separate and individual equipment, component, part, or structure.

B. No equipment, system or subsystem shall be checked, started up or placed into service unless all components of that system or subsystem required to be available and in service, including instrumentation, safety and other ancillary and pre-requisite systems, are complete and operable as intended by the contract documents.

C. Unless specified elsewhere in the contract documents, the Contractor shall provide all labor, special tools, special testing devices or equipment, chemicals, lubricants, operating fluids, fuel, electricity, water, filters, and other expendables required for checkout, startup, and commissioning.

D. No equipment, system or subsystem shall be commissioned prior to the completion of training of the City's personnel, receipt by the City of applicable approved Operations and Maintenance Manuals, and receipt by City of applicable spare parts and special equipment required for the equipment, system or subsystem.

1.06 EQUIPMENT CHECKOUT

A. Develop and maintain a detailed Equipment Checkout Schedule. The schedule shall become a part of the overall Commissioning Plan. Check and certify with equipment supplier and/or manufacturer's representative, that all equipment is in accordance with the applicable technical specifications. The intent of equipment checkout is to certify that equipment has been properly installed and is functioning such that it may be safely operated to facilitate further equipment testing, system testing or other performed checkout and testing. If no specific requirements are specified, the check out and certify that the installation is complete, correct and meets the equipment manufacturer's installation requirements. Written certification shall be provided. Maintain all responsibilities for equipment until such equipment is commissioned and turned over to the City.

1.07 EQUIPMENT TESTING

A. Develop and maintain a detailed Equipment Testing Schedule. The schedule shall become a part of the overall Commissioning Plan. Determine if equipment testing shall immediately follow checkout, or whether system testing, or ancillary systems are required to be complete in order to properly complete equipment testing. The intent of equipment testing is to certify that equipment is operating and functioning within the performance requirements of the technical specifications. Equipment testing shall be completed and documented in accordance with the technical specifications and the manufacturer's requirements. Written certification shall be provided. All testing verifications and data shall be documented and attached to the certification. Maintain all responsibilities for equipment until such equipment is commissioned within a system and turned over to the City.

1.08 SYSTEM TESTING

A. Develop and maintain a detailed System Testing Schedule. The schedule shall become a part of the Commissioning Plan. The intent of system testing is to certify that all equipment within a system has been properly integrated and operate and function in concert with other equipment to meet the performance requirements for the entire system. As a minimum, verify and certify that all equipment and components within a system meet the technical specifications for materials of construction for the intended service, performance range and settings, and all equipment within a system has been checked out, tested and certified for further testing and startup. Where appropriate, water shall be used in lieu of the intended chemical or process fluid for the system. Equipment and devices shall be tested, calibrated, and documented in accordance with the technical specifications and the manufacturer's requirements. Written certification shall be provided. All testing verifications, data and calibration results shall be documented and attached to the certification. Maintain all responsibilities for systems until such system is commissioned and turned over to the City.

B. Subsequent to individual system testing, operate systems to facilitate other testing and training of City personnel. Operate and maintain the equipment and systems but said operation shall not constitute the acceptance of the systems or commencement of any warranty periods. Operation and maintenance of the systems shall not impact the City's continuing operations.

1.09 SYSTEMS START-UP

A. As part of the Commissioning Plan or in order to comply with a request by the City for partial utilization of any part of the Work, start-up systems utilizing the appropriate chemical or process fluid. Prior to start-up of any system, confirm that all equipment and components within a system have been tested and certified, and that all pre-requisite systems, analyzers and safety systems and devices are functioning and available for service.

B. During system start up, chemical or process fluid shall be introduced to the system. Equipment shall be retested as appropriate and calibration verified. As defined elsewhere, individual systems shall be operated until acceptable to the City.

1.10 COMMISSIONING OF THE WORK

A. General

1. As a prerequisite to the City's issuance of the Certificate of Substantial Completion, start up equipment and systems in a sequence and manner to place into service all the Work. Conduct performance testing as described hereafter. Perform all tests with own forces and such equipment representatives and other experts as may be required by the Specifications or necessary for a successful test. Provide sufficient technical and/or supervisory personnel to be fully responsible for all operations and coordination of the tests from their beginning to their satisfactory.

2. Include as a part of the lump sum price bid for the Project, all operating costs, until satisfactory completion of all performance tests, or until the facility is put into operation by the City, whichever comes first. Operating costs shall be understood to include, but not be limited to, the costs of: **labor, fuel, water, heating, electrical power and lubricants**. City will be responsible for the costs of: **all treatment chemicals.** The Contractor shall be responsible for maintenance during the testing period and for repair of any damage resulting from the testing procedure. At all times, have sufficient personnel to handle an emergency. Provide reimbursement to the City should he have to make repairs with his own forces for damage caused by the Contractor’s actions or inactions.

3. Wages and salaries as may be required by any and all tests specified herein shall be paid for by the Contractor and included in the lump sum price bid. Such wages and salaries shall include any premium time costs incurred to complete the tests as scheduled or as required.

4. Dispose of all water used during the tests, in addition to wastes resulting from the tests. The method of disposing the water and wastes shall be in accordance with all applicable Laws and Regulations and shall be subject to approval by the City. Pumping water for testing into the distribution system is not allowed until its quality meets requirements for public water supplies. Costs for the disposal of water and wastes shall be included in the lump sum price bid.

5. Include costs for the above and below mentioned tests in unit and lump sum price bid for the Project.

B. Commissioning Plan

1. Prepare a detailed Commissioning Plan. Develop the general sequencing of the testing. In general, the sequence shall focus on the testing of individual pieces

of equipment prior to testing entire systems including automatic control systems.

C. Prior To Commissioning

1. At least 30 days prior to the proposed testing, conduct a meeting with the City and Engineer to discuss the Commissioning Plan and to finalize roles, responsibilities, proposed schedules and required documentation of the tests. Such discussions shall in no way relieve the Contractor of the responsibility of conducting the test expeditiously and with an adequate number of personnel to handle all emergencies. Subsequent to the meeting and before testing begins, make changes to the Commissioning Plan as determined at the meeting, and issue the final Commissioning Plan. No testing shall begin until the final Plan is issued to all parties.

D. Mechanical Performance Demonstration (MPD)

1. Provide the City at least 14 days written notice prior to the commencement of mechanical performance demonstration and training. Demonstrate to the City, in the presence of Engineer's personnel, that the manual and automatic controls, performance over full operative range, efficiency, safety items, alarms, etc., of each mechanical and electrical item of equipment will operate in accordance with the design intent as indicated by the Drawings and/or described in the Specifications. At this time, provide instruction and train the City's personnel in the operation of all equipment, controls, safety devices, etc.

E. Initial Plant Performance Tests (IPPT)

1. After the mechanical performance demonstration has been successfully completed, in the opinion of the City, commence the initial plant performance test. The test shall consist of a preliminary 24-hour operation test of the facility or subsystem. The 24-hour test shall commence after all Work has been started up and operating integrally with all systems. If, in the opinion of the City, the results of the operational test are satisfactory, the City will give written notice to proceed with the Final Mechanical Performance Tests. If, in the opinion of the City, the results of the operational test are unsatisfactory, the City shall provide a written list of deficiencies requiring correction prior to retest. The City reserves the right to have any portion of or the entire operational test retested until, in the opinion of the City, the facilities are completely operational.

F. Final Plant Performance Tests (FPPT)

1. Final Plant Performance Tests shall cover a continuous **two-week** period while the facility is in continuous normal operation. During the Final Plant Performance Tests, demonstrate, to the satisfaction of the City, with Engineer's personnel present, that all equipment is coordinated and operating properly; that

all controls, safety features, and alarms operate satisfactorily in coordination with the equipment installed; and that installed equipment complies in all respects mechanically and electrically with applicable Drawings and Specifications. Provide sufficient technical and/or supervisory personnel to be fully responsible for mechanical operation of the facilities. The City will be present during the entire test period to provide direction in regards to water treatment requirements and plant production rates. Upon completion of the test period, correct all items from the written list of operating problems, equipment malfunctions, or other deficiencies related to plant operations and retest the affected system. The retesting shall be performed for a time period sufficient to demonstrate the proper operation of the system. This time period will not exceed two-weeks.

G. After Commissioning

1. After receiving from the City written acceptance of the Final Plant Performance Tests, terminate responsibilities relative to operation of the facility. The City will assume this responsibility. However, remain responsible for any further training or extended run-in or adjustment periods for specific pieces of equipment or systems as required by the Specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of City-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of City-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.04 INFORMATIONAL SUBMITTALS

A. Utilities and Mechanical and Electrical Systems: List services and systems that cutting

and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

1. Include description of provisions for temporary services and systems during interruption of permanent services and systems, including plant operation.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.05 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of

the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to City that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.04 FIELD ENGINEERING

A. Identification: City will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and

directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity

of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in respective equipment sections.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 01 79 00 "Demonstration and Training" for requirements to train the City's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.04 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting City unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to City's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise City of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to City. Advise City's personnel of changeover in security provisions.

3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct City's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise City of changeover in utility services.
7. Participate with City in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.07 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit final completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final

inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Engineer.
    d. Name of Contractor.
    e. Page number.

1.09 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit City's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by City during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.

E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and

other foreign deposits.

c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used

during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Provide O&M manuals for the following equipment in accordance with listed requirements:

1. Transfer Pumps
2. Sodium Hypochlorite Feed System including Metering Pumps
3. Bulk and Day Tanks

C. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 77 00 “Closeout Procedures”.
3. Section 01 79 00 “Demonstration and Training”.

1.03 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.05 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of City.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.07 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by City's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of City's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.08 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by City's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.09 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance

procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by City's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

J. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

K. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

L. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

M. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

N. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

O. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

P. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 29 00 “Payment Procedures” for maintaining and exhibiting project record documents as a prerequisite for progress payments.
2. Section 01 73 00 "Execution" for final property survey.
3. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
4. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.03 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints
2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record prints and two sets of prints.

2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record- keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.04 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Work Change Directive.
k. Changes made following Engineer's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer.
    e. Name of Contractor.

1.05 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF

electronic file(s) of marked-up paper copy of Specifications.

1.06 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.07 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.08 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to

project record documents for Engineer's reference during normal working hours. As a prerequisite for monthly progress payments, exhibit the updated record documents for review by City and Engineer for accuracy and completeness.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for instructing City's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.03 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.04 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following

information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Engineer.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for City's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.05 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.06 COORDINATION

A. Coordinate instruction schedule with City's operations. Adjust schedule as required to

minimize disrupting City's operations and to ensure availability of City's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

1.07 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

1.08 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.09 INSTRUCTION

A. Engage qualified instructors to instruct City's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with City with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to City. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

F. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

G. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

H. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

I. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

J. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02 11 00
HAZARDOUS MATERIAL REMEDIATION

PART 1 – GENERAL

1.01 SUMMARY

A. Hazardous materials are identified in the Green Street Environmental Hazardous Materials Assessment Report dated July 17, 2018. Note that the hazardous materials survey conducted was limited to the Main Building at the Rockville WTP but does not preclude the presence of hazardous materials in the Chemical Building.

B. Hazardous materials known to exist at the WTP include (for more details on the number of occurrences and specific locations see the Hazardous Materials Assessment Report referenced above):

1. Asbestos Containing Building Materials

2. Lead-Based Paint

3. Mercury

C. It is the Contractor's responsibility to provide a 3rd party inspection of any suspected hazardous materials as well as preparation of a mitigation plan and development of a mitigation cost prior to the start of demolition. An allowance in the bid will be applied against any such costs. If any additional hazardous materials are identified by the Contractor during the course of construction, they shall be brought to the attention of the City and all work stopped in the area identified as containing or possibly containing hazardous materials.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, apply to this Section.

1.03 APPLICABLE STANDARDS AND GUIDELINES

A. The most recent edition of a relevant regulation, standard, or code shall be in effect. Where a conflict exists between the regulations, standards, codes, or these specifications, the more stringent requirements shall be utilized.

B. Contractor must adhere to all regulations impacting this work including those listed in this subsection and all applicable regulations that are not listed.

1. US Environmental Protection Agency (EPA)

a. 40 CFR 61 – Subpart M – NESHAP
b. 40 CFR 763 – AHERA

c. 40 CFR 260 – RCRA

2. US Occupational Safety and Health Administration (OSHA)

a. 29 CFR 1926.1101 – Asbestos in Construction
b. 29 CFR 1910.134 – Respirators
c. 29 CFR 1910.125 – Flammable Liquids
d. 29 CFR 1926.62 – Lead in Construction
e. 40 CFR 273 – Hazardous Waste Lamps
f. 29 CFR 1910.133 – Eye and Face Protection
g. 29 CFR 1910.135 – Head Protection
h. 29 CFR 1910.136 – Occupational Foot Protection
i. 29 CFR 1910.137 – Electrical Protective Devices
j. 29 CFR 1910.138 – Hand Protection

3. US Department of Transportation (DOT)

a. 49 CFR 170-180 – Hazardous Waste Transportation

4. Maryland Department of the Environment

a. COMAR 26.11.21, Code of Maryland Regulations Title 26 Department of the Environment Subtitle 11 Air Quality Chapter 21 Control of Asbestos;
b. COMAR 26.11.23, Code of Maryland Regulations Title 26 Department of the Environment Subtitle 11 Air Quality Chapter 23 Asbestos Accreditation of Individuals;
c. COMAR 09.12.20; Code of Maryland Annotated Regulations Title 09 Department of Labor, Licensing, and Regulation, Subtitle 12 Division of Labor and Industry, Chapter 20 Occupational Safety and Health Authority;
d. COMAR 26.13; Code of Maryland Annotated Regulations Title 26 Department of the Environment, Subtitle 13 Disposal of Controlled Hazardous Substances; and,
e. COMAR 26.16; Code of Maryland Annotated Regulations Title 26 Department of the Environment, Subtitle 16 Lead.

1.04 DESCRIPTIONS AND DEFINITIONS

A. General Definitions

a. Hazmat Contractor – Contractor, either prime or sub, who will perform hazardous material abatement.

B. Asbestos

1. Description of work:

a. This Section includes requirements for the removal of asbestos containing materials that must be completed prior to continuation of the contract work to the vicinity of the ACM. This Section describes the procedures and equipment

required to protect workers and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of the generated asbestos containing materials. Work shall be as indicated in accordance with the Contract Documents.

2. Definitions:

a. Action Level: An airborne concentration of asbestos fibers, in the breathing zone of a worker equaling 0.1 fibers per cubic centimeter of air calculated as an 8-hour time weighted average.

b. Amended Water: Water containing a wetting agent or surfactant with a surface tension of 29 dynes per square centimeter when tested in accordance with ASTM D 1331.

c. Asbestos: Includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content is at least one percent of the material by area.

d. Asbestos Control Area: Area where asbestos removal operations are performed isolated by physical boundaries assisting in the prevention of the uncontrolled release of asbestos dust, fibers, or debris. Personnel inside the asbestos control area shall be equipped with the protective equipment required as indicated herein and in the Asbestos Hazard Abatement Plan.

e. Asbestos Fibers: Fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

f. Asbestos Permissible Exposure Limit: 0.1 fibers per cubic centimeter of air as an 8-hour time weighted average as defined by 29 CFR 1926.1101(c) or other City legislation having legal jurisdiction for the protection of workers health.

g. Background: Normal airborne asbestos concentration in an area similar to the asbestos abatement area but in an uncontaminated (with asbestos) state.

h. Category I Non-Friable ACM: Asbestos containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763, section 1, Polarized Light Microscopy.

i. Category II Non-Friable ACM: Any material, excluding Category I non-friable ACM, containing more than 1 percent asbestos, as determined using the methods specified in appendix A, subpart F, 40 CFR part 763, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

j. Encapsulant: Specific materials in various forms used to chemically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are two types of encapsulant as follows which must comply with performance requirements as specified herein.

1) Removal Encapsulant (can be used as a wetting agent)

2) Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed)

k. Friable Asbestos Material: Material containing more than 1 percent asbestos and can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

l. Glovebag Technique: Asbestos removal and control techniques put forth in 29 CFR 1926.58 Appendix G, III A, B, C, D and 29 CFR 1926.58 Figure G 1.

m. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

n. Independent CIH: A Certified Industrial Hygienist hired by the Contractor to perform the work indicated herein. Person shall conduct personnel and area/environmental air sampling and shall be currently certified for comprehensive practice by the American Board of Industrial Hygiene. For the purpose of this contract, the Contractor shall retain the services of an independent certified industrial hygienist (CIH) not affiliated with the Contractor, for the duration of ACM removal to perform the Contractor's industrial hygiene tasks. Independent CIH tasks specified herein may be performed by a qualified technician under direct supervision of the Independent CIH. The AHAP shall include a list of tasks to be performed by the technician under the supervision of the Independent CIH and the name and qualifications of technician. The use of a technician shall not relieve the Contractor of responsibility for ensuring a safe working environment for asbestos removal and for maintaining supervision by the Independent CIH. All reports and submittals shall be reviewed and approved, and signed by the Independent CIH.

o. Personnel Sampling: Air sampling to determine asbestos fiber concentrations within the breathing zone of a specific employee, performed in accordance with 29 CFR 1926.1101.

p. Regulated Asbestos Containing Material: Friable asbestos containing material, Category I Nonfriable ACM that has become friable, Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

q. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers. At least three full shift samples per person are required to establish that person's TWA exposure.

r. Wetting Agent: That specific agent used to reduce airborne asbestos levels by physically bonding asbestos fibers to material to be removed. An equivalent wetting agent must have a surface tension of at least 29 dynes per square centimeter as tested in accordance with ASTM D 1331.

C. Lead-Based Paint

1. Description of Work:

a. This Section includes general requirements for providing equipment and labor for removing and disposing of structures and equipment coated with lead-containing paint and related work. There may also be lead joint seals on old pipe that need to be properly disposed of.

2. Definitions:

a. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."
b. Certified Industrial Hygienist (CIH): As used in this section, refers to a Certified Industrial Hygienist employed by the Contractor who is certified by the American Board of Industrial Hygiene in comprehensive practice.
c. Change Rooms and Shower Facilities: Rooms equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross contamination.
d. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).
e. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

D. Mercury

1. Description of Work:

a. This Section addresses the removal of mercury containing light bulbs and non-digital thermostats.

1.05 SUBMITTALS

A. Asbestos Submittals:

1. License: Contractor shall be licensed with the State of Maryland, for asbestos removal, and shall submit a copy of license prior to Notice to Proceed.
2. Schedule: Submit schedule indicating proposed methods and sequence of operations for asbestos removal work to the Engineer for review prior to commencement of work.
3. Asbestos Hazard Abatement Plan (AHAP): Submit a detailed plan of the safety precautions and work procedures to be used in the removal of materials containing asbestos. The plan shall be prepared, signed, and sealed by a principal of the Contractor. Plan shall include the following:

a. Emergency and fire evacuation for removing workers from the work zone in an emergency. A copy of this plan shall be filed with the local fire and police departments.
b. Plan for maintaining the security of the work zone. The security plan shall provide a means of preventing accidental or unauthorized entry.

c. Contingency plan addressing emergencies, equipment failures, and barrier failure. This plan shall include telephone numbers of representatives of the Asbestos Contractor to be contacted in emergencies.

d. The Contractor shall maintain a daily asbestos removal personnel access log, showing sign in/sign out of all persons entering the work zone. The Contractor shall submit a copy of the logs to the Engineer and Independent CIH on a weekly basis.

e. Removal plan shall include the precise personnel protective equipment to be used, the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal methods, interface of trades involved in the demolition, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment with anticipated exhaust flows for each work area (4 air changes per hour minimum), planned air monitoring strategies, and a detailed description of the method to be employed in order to control air emissions.

f. The removal plan must be approved by the Engineer prior to submitting for approval to the City and the Independent CIH. The above permit and approvals shall be completed prior to start of any asbestos work. The Contractor shall meet with the Engineer and Independent CIH prior to beginning work, to discuss in detail the AHAP. Once approved by the Engineer, City and Independent CIH, the plan will be enforced as a part of the Contract Documents. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for discussion and approval by the Engineer and Independent CIH prior to the start of work.

4. Testing laboratory: Submit the name, address, and telephone number of the testing laboratory selected for the analysis and reporting of the airborne asbestos fiber concentrations along with certification that persons performing the analysis have been judged proficient by successful participation within the last year in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program. Submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for analysis of bulk asbestos samples.
5. Independent CIH: Submit the name of the American Board of Industrial Hygiene certified Independent CIH selected to conduct personnel and area/environmental air sampling.
6. Submit detailed delivery tickets for landfill disposal, prepared, signed and dated by the Contractor, certifying the amount of asbestos materials delivered to the landfill, within 3 days after delivery.
7. Employee training: The Contractor shall document each employee training by submitting copies of certificates of training for all workers and supervisors involved with project. The Contractor shall also certify the training received by each employee involved with this asbestos removal project has received, at a minimum, training in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of

monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101.

8. Medical certification requirements: Provide a written certification signed by a licensed physician that all workers and supervisors have met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1910.134.
9. Air sampling results: Submit complete fiber counting and provide results to the Independent CIH for review within 16 hours of the sampling. Notify the Engineer and Independent CIH immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Engineer and the affected Contractor employees within 3 working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the Independent CIH.
10. Permits and Notifications: Notify the Engineer in writing 10 working days prior to the start of asbestos removal work. Submit a copy of all demolition permits and notifications submitted to the City and state agencies.
11. Rental equipment: Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.
12. Respirator program records: Submit records of the respirator program as required by ANSI Z88.2, 29 CFR 1910.134, 29 CFR 1926.1101.
13. Product Data: Submit product data, use instructions, and recommendations from the manufacturer of surfactant and encapsulant intended for use.

B. Lead-Based Paint Submittals:

1. Shop drawings shall be submitted as specified in Specification 01 33 00 (Contract Documents, Working Drawings, Shop Drawings, Product Data and Samples).
2. Instructions: Submit paint removal materials (if required). Include applicable material safety data sheets.
3. Qualifications of Certified Industrial Hygienist (CIH): Submit name, address, and telephone number of the CIH selected to perform responsibilities indicated under Subsection 1.4 "Requirements" portion of this specification. Provide previous experience of the CIH. Submit proper documentation that the CIH is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification.
4. Testing Laboratory: Submit the name, address, telephone number, and qualifications of the testing laboratory selected to perform the monitoring, testing, and reporting of airborne concentrations and TCLP results. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program. The laboratory shall be accredited under the Environmental Lead Laboratory Accreditation Program (ELLAP) Provide AIHA documentation along with date of accreditation/ re-accreditation. All air samples shall be collected and analyzed according to NIOSH Method 7082, or equivalent. All samples shall be analyzed by laboratories accredited by the American Industrial Hygiene Association for metals analysis. Submit copies of the test results within three calendar days of obtaining samples.

5. Written Compliance Program (WCP): The Contractor shall develop a site specific WCP to establish and implement practices and procedures for assuring that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter of air, the OSHA permissible exposure limit (PEL). This program is in addition to other OSHA hazard communication and safety and health requirements of the project, and shall be revised and updated at least every six months. The CIH shall review and sign the WCP prior to submission to the Engineer for review.

    a. The WCP shall establish methods for complying with this specification and 29 CFR 1926.62. The program shall apply to all Contractor employees associated with lead on the project, and to subcontractors working under the direct control of the Contractor who are associated with lead on this project. The WCP shall assign the specific responsibility for implementation and enforcement of the program to the Contractors' company management.
    b. The WCP shall contain each activity in which lead is emitted (e.g. equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices).
    c. The WCP shall contain a report of the technology considered in meeting the PEL and air monitoring data which documents the source of lead emissions.
    d. The WCP shall contain a work practice program which includes items required in the lead standard such as protective clothing and equipment, housekeeping, and hygiene facilities and practices.

6. Monitoring Results: Submit monitoring results to the Engineer within 3 working days, signed by the Contractor, testing laboratory employee performing the air monitoring, and the employee that analyzed the sample.
7. Salvage/Disposal Facility: Prior to starting work, submit the name, address, and phone number of the salvage/disposal facility anticipated to be used.
8. Records: Completed and signed manifest or bill of lading form from salvage or disposal facility if landfill or salvage facility is to be used.
9. Certification of Medical Examinations.
10. Employee training and license certificates and abatement company business entity license

C. Mercury and Submittals:

1. Shop drawings shall be submitted as specified in Standard Specifications 01 33 21 (Contract Documents, Working Drawings, Shop Drawings, Product Data and Samples).
2. Mercury Hazard Control Plan: Prepare a hazard control plan mercury that includes:

    a. Personal protective equipment to be used in the removal and disposal of Mercury containing wastes.
    b. Administrative control measures to limit worker exposure.
    c. Methods to safely remove mercury containing light bulbs and thermostats.
    d. Drawing showing the location of storage areas for the removed light bulbs.
    e. Schedule for the removal and disposal/recycling of light fixtures and thermostats.

3. Manifests:

    a. Shipping records for mercury containing fluorescent lamps

D. After conclusion of Work:

1. Detailed statement of all asbestos and other hazardous materials removed.
2. Detailed statement of any asbestos and other hazardous materials remaining.
3. Copy of waste manifests with signature from final disposal site. Note that work under this section is not complete and final payment will not be made until all manifests showing final disposal are delivered to the City.

1.06 REQUIREMENTS

A. Asbestos:

1. Medical Examinations: Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101. This requirement must have been satisfied within the past year and shall be continued annually in effect through the duration of this project. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation.
2. Medical Records: Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 30 years after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or City, and an employee's physician upon the request of the employee or former employee.
3. Training: Within one year prior to the assignment of asbestos work, each employee shall be instructed with regard to the hazards of asbestos, safety and health precautions, the use and requirements for protective clothing, equipment, and respirators, and the association of cigarette smoking and asbestos related disease, and all additional requirements of 29 CFR 1926.1101. Furnish each employee with a respirator fit test as required by 29 CFR 1926.134 and 29 CFR 1926.1101. Fully cover engineering and other hazard control techniques and procedures. Employee training shall be renewed annually and respirator fit test shall be completed every 6 months for the duration of this project.
4. Permits, Licenses, and Notifications: Obtain necessary permits and licenses in conjunction with asbestos removal, hauling, and disposition, and furnish timely notification of such actions required by City, state, regional, and local authorities. Notify the EPA, the City, and the Engineer in writing 10 days prior to the commencement of work in accordance with 40 CFR 61, Subpart M.
5. Safety and Health Compliance: In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, city, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61, SUBPART A, 40 CFR 61, SUBPART

M. Submit matters of interpretation of standards to the City for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the City shall apply.

6. Respiratory Protection Program: Establish and implement a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134.
7. Hazard Communication: Adhere to all parts of 29 CFR 1910.1200 and submit to the Engineer with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site.

B. Lead-Based Paint:

1. CIH Responsibilities include certifying worker training, review and approval of compliance program, direct air monitoring, ensure work is performed in strict accordance with specifications at all times, and ensure hazardous exposure to personnel and to the environment are adequately controlled at all times. Train each employee performing structure and paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1910.1025.
2. Training Certification: Submit certificates signed and dated by the CIH and by each employee stating that the employee has received training as indicated herein.
3. Hazardous Waste Management Plan: The Hazardous Waste Management Plan shall comply with applicable requirements of federal, state, and local hazardous waste regulations for materials deemed hazardous, and shall address:

    a. Identification of hazardous wastes associated with the work, estimated quantities of wastes to be generated and disposed of, names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24 hour point of contact.
    b. Furnish two copies of state hazardous waste permits and EPA Identification numbers, names and qualifications (experience and training) of personnel who will be working on site with hazardous wastes, list of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment, spill prevention, containment, and cleanup contingency measures to be implemented, work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.

4. Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926. Submit matters regarding interpretation of standards to the Engineer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.
5. Pre Demolition Conference: The CIH and Contractor representative shall meet with the Engineer to discuss in detail the written compliance program for the removal of structures containing lead paint, including work procedures and precautions for the work plan

1.07 AUTHORITY TO STOP WORK

A. The City, the Engineer, and/or any representative of the City (e.g. the City's Industrial Hygienist) have the authority to issue a work stoppage at any time during the abatement work if they deem that conditions are in violation of these specifications or any local, state, or federal regulations.

B. Work shall be stopped if at any time airborne fiber concentrations in the containment exceed ½ of the maximum use concentration of the least protective respirator being used in the containment.

C. Work shall be stopped if at any time airborne fiber concentrations outside of the containment exceed 0.01 fibers per cubic centimeter or the measured background level, whichever is greater.

D. Once a work stoppage has been issued, the Contractor shall take corrective steps including but not limited too the following:

1. Cease all asbestos removal activities, or any other activities that disturbs ACM.
2. Repair any fallen, ripped, or otherwise failed work area isolation measures.
3. Maintain, in operation, all work area isolation measures
4. Maintain all worker protection.
5. Fog the air in the work area with a mist of amended water to reduce airborne fiber levels.
6. Evaluate the need for improved engineering controls or work practices.

E. The Contractor shall not recommence work until conditions have been corrected and authorized in writing by the City or Engineer.

F. Delays, stand-by time, and expenses necessary for Contractor to take corrective action, resolve any violations of these specifications or applicable laws shall be at the Contractor's expense.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT – GENERAL

A. Supplies and equipment shall be designed for abatement projects.

B. Supplies and equipment brought on-site shall not introduce hazardous materials into the work area.

C. Rental Equipment – If any rental equipment will be used in the work area, the Contractor must provide written notification to the rental company describing the use of the tools and the expectation that asbestos and lead levels may exceed the OSHA PEL. The rental company must provide written acknowledgment and approval of the intended use.

2.02 MATERIALS AND EQUIPMENT – ASBESTOS

A. Removal Encapsulant:

1. Provide a penetrating type encapsulant designed specifically for the removal of asbestos containing material. Use a material that results in wetting of the ACM and retardation of fiber release during disturbance of the material equal to or greater than that provided by water amended.
2. Provide water to which a surfactant has been added. Use a mixture of surfactant and water which results in wetting of the ACM and retardation of fiber release during disturbance of the material equal to or greater than that provided by the use of one ounce of a surfactant consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with five gallons of water.

B. Polyethylene Sheet:

1. Polyethylene film in the largest sheet size possible to minimize seams, 6.0 mil thick, clear, frosted, or black. Film shall be flame resistant conforming to the requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame Resistant Textiles and Films.

C. Miscellaneous Materials:

1. Duct tape in 2" or 3" widths with an adhesive which is formulated to aggressively stick to sheet polyethylene.
2. Spray adhesive which is specifically formulated to stick to sheet polyethylene.
3. 6.0 mil thick leak-tight polyethylene bags provided with 4 labels per bag. Labels shall read:

   Fist Label:

   CAUTION
   CONTAINS ASBESTOS FIBERS
   AVOID OPENING OR BREAKING CONTAINER
   BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

   Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard:

   DANGER
   CONTAINS ASBESTOS FIBERS
   AVOID CREATING DUST
   CANCER AND LUNG DISEASE HAZARD
   BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
   ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

   Third Label: Provide in accordance with U.S. Department of Transportation regulation on hazardous waste marking. 49 CFR Parts 171 and 172. Hazardous Substances: Final Rule. Published November 21, 1986 and revised February 17, 1987:

RQ HAZARDOUS
SUBSTANCE,
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

Fourth Label:

NAME OF GENERATOR
NAME OF CONTRACTOR
CONTRACTOR'S REMOVAL LICENSE NUMBER
DATE BAG WAS SEALED

2.03 MATERIALS AND EQUIPMENT – LEAD BASED PAINT

A. Equipment:

1. Respirators: Furnish personnel who will be exposed to lead-contaminated dust with appropriate respirators approved by the NIOSH, Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1910.134. Four respirators shall be provided to the City for use during demolition. Contractor shall furnish the City an adequate supply of filter cartridges to complete the demolition.
2. Special Protective Clothing: Furnish personnel who will be exposed to lead contaminated dust with appropriate disposable protective whole body clothing, head covering, gloves, and foot coverings. Furnish appropriate disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CIH. The Contractor shall furnish the City 10 sets of disposal protective clothing for use by the CITY's construction personnel and the Engineer.
3. Rental Equipment Notification: If rental equipment is to be used during lead containing paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the Engineer.
4. Vacuum Filters: UL 586 labeled HEPA filters.

B. Paint Removal Products (if required):

1. Submit applicable Material Safety Data Sheets for paint removal products used in paint removal work where required by the Written Compliance Program. Use the least toxic product acceptable to the CIH.

C. Abrasive Materials (if required):

1. Abrasive blasting materials shall meet the requirements of MIL A 22262 for limits on chemical composition and hazardous material ingredients.

2. Limits on the Composition of Abrasive Materials (if required): The soluble metal content and the total metal content shall not exceed values which would cause a material to be classified as a hazardous waste as specified in MIL A 22262.

PART 3 – EXECUTION

3.01 ASBESTOS

A. Equipment:

1. Respirators: Furnish to the Engineer two complete sets of personal protective equipment, including filters, as required for entry to the asbestos control area at all times for inspection of the asbestos control area. Provide manufacturer's certificate of compliance for all equipment required to contain airborne asbestos fibers. Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. Provide personnel engaged in the removal and demolition of asbestos materials with respirators complying with 29 CFR 1926.1101 and 29 CFR 1910.134.
2. Protective Clothing: Provide personnel exposed to asbestos with disposable protective whole body clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Contractor shall make available 10 complete sets of protective clothing to the Engineer.
3. Work Clothing: Provide cloth work clothes for wear under the disposable protective coveralls and foot coverings and either dispose of, or properly launder them as recommended by the CIH after use.
4. Decontamination: Provide a temporary, negative pressure decontamination area which shall include a separate decontamination locker room and a clean locker room with a shower that complies with 29 CFR 1910.141(d)(3) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter to 5 microns to remove asbestos contamination with approved water filtration equipment. Dispose of filters and residue as asbestos waste. Discharge clean water to the existing sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste. Each asbestos control area shall be provided with a minimum of one decontamination area. Entrance into or out of the asbestos control area shall be through the decontamination area or equipment access.
5. Eye Protection: Provide goggles to personnel engaged in asbestos operations when the use of a full-face respirator is not required.

6. Warning Signs and Labels:

   a. Provide warning signs printed in English and Spanish at all approaches to asbestos control areas containing concentrations of airborne asbestos fibers. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

   b. Warning Sign: Provide vertical format conforming to 29 CFR 1910.145(d)(4), and 29 CFR 1926.1101(k) minimum 20 by 14 inches displaying the following legend in the lower panel:

Legend	Notation
Danger	1-inch Sans Serif Gothic or Block
Asbestos	1-inch Sans Serif Gothic or Block
Cancer and Lung Disease	1/4-inch Sans Serif Gothic or Block
Authorized Personnel Only	1/4-inch Gothic
Respirators and Protective Clothing are Required in this Area	1/4-inch Gothic

   Spacing between lines shall be at least equal to the height of the upper of any two lines.

   c. Warning Labels: Provide labels conforming to 29 CFR 1926.1101(k) of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

7. Local Exhaust System: Provide a local exhaust system in the asbestos control area in accordance with ANSI Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the containment. Local exhaust shall be operated 24 hours per day, until the asbestos control area is removed, and shall be equipped with HEPA filters. Local exhaust equipment shall be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24 hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. In no case shall the building ventilation system be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment shall conform to ANSI Z9.2 and UL 586. The local exhaust system shall terminate out of doors, outside the asbestos control area.

8. Tools: Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.
9. Rental Equipment: If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

B. Work Procedures:

1. Perform asbestos related work in accordance with 29 CFR 1926.1101 and as specified herein. Use wet removal procedures, full containment, or glovebag techniques as indicated and approved in the Asbestos Hazard Abatement Plan. Compressed air or high pressure water shall not be used. Other removal techniques not indicated herein shall be submitted to the Engineer for approval prior to commencement of work. State and City approval of other removal techniques shall be included with the Asbestos Hazard Abatement Plan.
2. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, or applying cosmetics shall not be permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection provisions of this specification are complied with by the trade personnel. If an asbestos spill occurs outside of the asbestos control area, stop work and inform the Engineer and Independent CIH immediately, correct the condition to the satisfaction of the Independent CIH including clearance sampling, prior to resumption of work.

C. Temporary Power, Water, and Heat:

1. The Contractor shall be responsible for providing temporary electric power, water, and heat where required. The Contractor shall be responsible for costs associated with the setup, usage, and removal of temporary service.

D. Protection of Existing Work to Remain:

1. Perform demolition work without contamination of adjacent work. Where such work is contaminated as verified by the Engineer using visual inspection or sample analysis, it shall be decontaminated by the Contractor at no expense to the City as deemed appropriate by the Independent CIH and Engineer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the Independent CIH, work may proceed.

E. Asbestos Control Area Requirements:

1. Provide suitable tools for removal of roof tar. Any dust resulting from the removal operation shall be collected either by HEPA dust collector or HEPA vacuuming along the cut line.
2. Roof level heating and ventilation air intake sources shall be isolated or the ventilation system shall be shut down during removal operations.
3. Glovebag: A variance for asbestos removal using glovebag techniques as indicated in 29 CFR 1926.1101 shall be approved prior to the start of work. Upon approval, establish designated limits for the asbestos work area with the use of rope or other continuous barriers; maintain all other requirements for asbestos control areas except for local exhaust. Also, where an enclosure is not provided, conduct area monitoring of airborne asbestos fibers during the work shift at the designated limits of the asbestos work area at such frequency as recommended by the Independent CIH and conduct personnel samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work). If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter whichever is lesser, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Independent CIH. This sampling may be duplicated by the Engineer. If the air sampling results obtained by the Engineer differs from those obtained by the Contractor, the Engineer's results shall prevail. If adjacent areas are contaminated as determined by the Independent CIH, clean the contaminated areas, monitor, and visually inspect the area as specified herein.

F. Asbestos Handling Procedures:

1. General Procedures: Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6.0 mil plastic disposal bags. Where unusual circumstances prohibit the use of 6.0 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Engineer for approval.

G. Sampling:

1. Air Sampling: Personnel sampling of airborne concentrations of asbestos fibers shall be performed by the Contractor in accordance with 29 CFR 1926.1101 and as specified herein. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis.
2. Sampling Prior to Asbestos Work: Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each removal control area. Establish the background by performing area sampling in similar but uncontaminated sites in the building.
3. Personnel air sampling During Asbestos Work: The Independent CIH shall provide personnel sampling as indicated in 29 CFR 1926.1101.
4. Sampling After Final Clean Up (Clearance Sampling): Provide area sampling for asbestos fibers using aggressive air sampling techniques as defined in the EPA Guidance Document 560/5 085 024 (Purple Book) and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean up but before removal of the containment or the asbestos work control area. After final cleanup and the asbestos

control area is dry but prior to clearance sampling, the Independent CIH shall perform a visual inspection to insure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. The Independent CIH shall collect at least 3 air samples. The asbestos fiber counts from these samples shall be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value, the Contractor shall take appropriate actions to re clean the area and shall repeat the sampling and analysis at the Contractor's expense. Phase Contrast Microscopy (PCM) shall be used to analyze air samples

H. Lock Down:

1. Prior to removal of plastic barriers and after pre clearance clean up of gross contamination, a visual inspection by the Independent CIH of all areas affected by the removal of the asbestos contaminated materials for any visible fibers shall be conducted. A post removal (lock down) encapsulant shall then be spray applied to ceiling, walls, floors and other areas exposed in the removal area. The exposed area shall include but not be limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers.

I. Site Inspection:

1. While performing asbestos removal work, the Contractor shall be subject to on site inspection by the Engineer. If the work is found to be in violation of the Contract Documents, the City or its representative may issue a stop work order to be in effect immediately and until the violation is resolved. Standby time required to resolve the violation shall be at the Contractor's expense.

J. Clean-Up and Disposal:

1. Housekeeping: Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. Do not blow down the space with compressed air. When asbestos removal is complete, all asbestos waste is removed from the work site, and final clean up is completed, the Independent CIH shall certify the area as safe before the signs can be removed. The Contractor shall re clean all areas showing dust or residual materials. If re cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re cleaning. The Independent CIH shall certify that the area is safe in writing before unrestricted entry is permitted. The Engineer shall have the option to perform monitoring to certify the areas are safe before entry is permitted.

K. Disposal of Asbestos:

1. Procedure for Disposal: Disposal of asbestos waste shall be completed in accordance with COMAR 26.04.07.13 and as indicated herein. Collect asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and

place in sealed fiberproof, waterproof, non returnable containers (e.g. double plastic bags 6.0 mil thick, cartons, drums or cans). Wastes within the containers shall be wetted to insure the security of the material in case of container breaching. Affix a label as indicated herein to each bag. Dispose of waste asbestos material at the on-site rubble landfill. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste containing drums or skids will be assigned by the Engineer. Procedure for hauling and disposal shall comply with 40 CFR 61, SUBPART M, state, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

2. Asbestos Disposal Quantity Report: The Contractor shall record and report, to the Engineer and Independent CIH, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as related to the Asbestos Data Sheet description, and a total cubic footage for the total amount of asbestos containing material released for disposal

3.02 LEAD-BASED PAINT

A. Worker Protection

1. Exposure Monitoring: Representative personal air samples shall be collected at the beginning of the lead removal work to determine employee lead exposures. Tasks involving potential lead exposure include, but are not limited to, paint removal operations, clean up, and debris handling operations. Full shift (at least 7 hours) air samples shall be collected for each job classification in the exposure area.

    a. During the initial monitoring, workers performing the following activities (or equivalent) shall be protected to the anticipated exposure levels, which are dictated by the lead standard:

        - 500 µg/m3: Manual demolition of structures containing lead containing coatings or paint (e.g., dry wall), manual scraping, manual sanding, heat gun applications, power tool cleaning with dust collection systems, and spray painting with lead paint.
        - 2,500 µg/m3: Using lead-containing mortar, lead burning, or conducting the following activities where lead-containing coatings or paint are present: rivet busting, power tool cleaning without dust collection systems, clean-up activities where dry expendable abrasives are used, and the movement and removal of abrasive blasting enclosures.
        - More than 2,500 µg/m3: Activities involving lead containing coatings or paint on structures by abrasive blasting, welding, cutting, and torch burning.

1) Protection requires compliance with the necessary respiratory protection, personal protective clothing and equipment, change areas and washing facilities, blood lead and zinc protoporphyrin monitoring, and employee training. The protection measures shall be modified, as necessary, after the exposure results are received.
2) Where initial monitoring indicates that lead exposures are below the Action Level, and where activities and conditions remain the same as at the time of initial sampling, additional monitoring need not be repeated for that work activity.
3) Where the initial monitoring of a given work activity indicates that lead exposures are at or above the Action Level, additional exposure monitoring shall be conducted at the frequencies established in the lead standard (at least every two months if above the Action Level, but below the PEL, or every month if above the PEL).
4) All exposed employees and CITY construction personnel shall be notified in writing of the monitoring results within twenty-four hours after receiving the results.

b. Action Level: The Action Level for airborne lead exposure is 30 µg/m3, as an 8-hour time weighted average (TWA) concentration, without regard to the use of respirators.

Whenever workers' or CITY construction personnel airborne lead exposures exceed the Action Level, the Contractor shall implement the following:

1) Periodic Exposure Monitoring
2) Employee Information and Training
3) Employee Medical Surveillance and Medical Removal Protection
4) Housekeeping
5) Recordkeeping
6) Signs and Regulated Areas

c. Permissible Exposure Limit: The Permissible Exposure Limit (PEL) for airborne lead exposure is 50 µg/m3, as an 8-hour TWA concentration. When the work area contains airborne lead levels above the PEL the Contractor shall implement:

1) Compliance Program
2) Respirator Protection
3) Protective Clothing and Equipment
4) Hygiene Facilities and Practices

d. Respirator Protection:

1) After engineering controls and work practices have been implemented, respiratory protection shall be used to maintain employees' lead exposures below the PEL. Respirators shall be worn by all employees, other

Contractors, inspectors, CITY construction personnel, or observers who enter regulated areas.

2) The Contractor shall develop a written Respiratory Protection Program in compliance with 29 CFR 1910.134, paragraphs (b), (d), (e), and (f), and the OSHA lead standard. The program shall address the selection, use, maintenance, and inspection of respirators, and qualifications for respirator users

e. Protective Clothing and Equipment:

1) The Contractor shall provide protective clothing and equipment and ensure they are worn by all employees whose lead exposures' exceed the PEL, or who enter the regulated areas. The Contractor shall also provide protective clothing for CITY construction personnel whenever lead exposure exceeds the PEL.
2) Protective clothing shall include washable and/or disposable full body coveralls, gloves, foot coverings, and hoods. Other protective equip-ment shall include faceshields, hard hats, eye protection, and hearing protection as appropriate.
3) Disposable protective clothing shall be used for no more than one work day. Such clothing may have to be disposed of as hazardous waste.
4) Reusable protective equipment shall be cleaned or replaced weekly if exposure levels are less than 200µg/m3.
5) Clothing shall not be removed or "cleaned" by any means which could reintroduce the lead dust into the ambient air. This includes brushing, shaking, and blowing. Vacuums equipped with HEPA filters shall be used for this purpose.
6) Reusable coveralls shall be collected at the end of each workday in closed containers. The containers shall be labeled in accordance with the requirements of 29 CFR 1926.62(g)(2) (vii). Contaminated clothing shall be cleaned in accordance with all Federal, State, or local regulations pertaining to lead-contaminated laundry and water storage. Laundries shall be informed that the clothing contains lead.
7) The Contractor shall provide the necessary clothing and equipment for use by the City and its designated representatives.

f. Personal Hygiene Facilities and Practices:

1) Clean change areas shall be provided when employees' lead exposures exceed the PEL. The change areas shall be equipped with storage facilities for street clothing and a separate area for the removal and storage of lead-contaminated clothing and equipment. They shall be designed and used so that contamination of street clothing does not occur. Employees shall not leave the project site wearing any clothing worn while performing lead activities. Airborne lead exposures in the change area shall be maintained below the Action Level.

2) Shower facilities shall be provided whenever employees' lead expo-sures exceed the PEL. Shower facilities shall comply with OSHA Sanitation Standard, 29 CFR 1910.141. All employees whose lead exposures exceed the PEL shall shower at the end of each work shift or before leaving the project area. The shower facilities shall be made available for use by the CITY and its representatives, such as inspec-tors.

3) Arrangements shall be made for the proper disposal of the shower and wash water after filtration through a three stage 100, 50, and 5 micron filtering system at a minimum.

4) Clean lunch areas shall be provided for all employees whose lead exposures exceed the PEL. An adequate number of clean lavatory and hand washing facilities shall be provided. These shall comply with the OSHA Sanitation Standard, 29 CFR 1910.141.

5) Eating, drinking, smoking, chewing of food or tobacco products, or the application of cosmetics shall not be permitted in any areas where the lead exposures exceed the PEL. Through washing of hands and face is required prior to undertaking any of these activities.

g. Medical Surveillance and Medical Removal Protection:

1) All employees and CITY construction personnel who are exposed to lead above the Action Level in a single day during this project shall be provided with initial and periodic medical examinations and blood lead tests as required by the lead standard. A final blood lead test shall be provided for each worker upon completion of the project, or at any time a worker's employment at the project ceases.

2) When blood lead levels over 50 µg/dl are encountered, the Contractor shall provide for the temporary removal of employees from lead exposure above the Action Level. The required medical surveillance and periodic blood lead tests shall be provided in strict accordance with the lead standard throughout the removal project. The Contractor shall notify the City whenever construction personnel blood levels are over 50 µg/dl.

3) Employees who will be required to wear a respirator or who request one shall be provided with a respirator and the necessary medical examinations to determine their ability to wear a respirator.

4) All examinations shall be provided by the Contractor and shall be performed by or under the direct supervision of a licensed physician.

h. Employee Information and Training:

1) The Contractor shall provide lead training for all employees who are exposed to lead above the Action Level for this project.

2) The content of lead training shall include, as a minimum, those items listed in the lead standard.

3) Training shall also include hazard communication in accordance with 29 CFR 1926.59.

4) The Contractor shall notify other employers at the project site of the nature of the lead exposure work, the need to remain out of exposure areas, the warning sign and labeling system in effect, and the potential need for them to take measures to protect their employees.

i. Signs and Regulated Areas:

1) The Contractor shall establish a regulated area surrounding activities where lead exposures exceed the Action Level. This includes locations where lead-containing debris is handled or transferred to storage containers.
2) The regulated area shall be demarcated by ropes, tape, walls, or containments with caution signs posted at all accessible sides. Signs shall contain the legend:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

3) The Contractor shall control access of persons into regulated areas. Access shall be limited to individuals with proper training and personal protective equipment, and medical surveillance testing.
4) All persons entering regulated areas shall wear protective clothing and respirators.
5) Eating, drinking, smoking, and chewing of food or tobacco products shall be prohibited in regulated areas and in any area where lead exposures exceed the Action Level.

j. Recordkeeping:

1) All records relating to training, medical examinations, blood lead monitoring, and exposure monitoring shall be maintained by the Contractor.
2) All records shall be available for review by the City or its representative upon request.

B. Waste Classification, Handling, and Disposal

1. General:

a. For the purposes of this Contract, the Contractor shall assume that rubble generated from this demolition will not be classified as hazardous waste.
b. The City is the Generator of the debris for permitting purposes, and will obtain the required EPA Identification number as needed. The Contractor shall be responsible for assuring that all sampling, testing, handling, storage, transportation, and disposal requirements are properly implemented, including satisfactory training of job site personnel and the decontamination and cleaning of

all items and equipment prior to removal from the site in accordance with all local, state and federal regulations.

c. The Contractor shall develop a written program to establish and implement practices and procedures for the proper sampling, testing, handling, and disposal of waste generated on the project. The name, address, and qualifications of the testing laboratory, transporter, and disposal facility shall be provided. Only licensed transporters and disposal facilities shall be used. The program shall include procedures that will be followed to assure that all reusable items such as equipment, containment materials, and scaffolding are cleaned free of lead prior to removal from the site.

d. The program shall effectively and clearly communicate the means for complying with this specification, and EPA SW-846 sampling requirements. Generic statements shall not be used. Specific methods, procedures, and details are required.

2. Waste Classification:

a. Testing Prior to Landfill Disposal: Debris generated by the demolition of structures or equipment shall be tested in accordance with 40 CFR 261, Appendix II, Method 1311 Toxicity Characteristics Leaching Procedure (TCLP), to determine if it is hazardous.

b. Collect and analyze representative samples of the debris for each demolished structure or equipment. Segregate demolition debris from each structure from other debris until the results of the samples have been received and the disposition of the segregated materials have been determined. Analyze a minimum of 2 samples for each 10,000 square foot of building floor area as specified herein.

c. Sampling and testing shall be performed by a qualified laboratory acceptable to the City.

d. Lead paint debris is classified as hazardous waste if, after testing by TCLP, the leachate contains any of the 8 metals or other hazardous substances in concentrations at or above limits established in 40 CFR 261:

Arsenic	5.0 mg/L
Barium	100.0 mg/L
Cadmium	1.0 mg/L
Chromium	5.0 mg/L
Lead	5.0 mg/L
Mercury	0.2 mg/L
Selenium	1.0 mg/L
Silver	5.0 mg/L

e. The above includes only those elements typically associated with paints. Other substances may be present which may cause debris to be classified as hazardous waste as defined in 40 CFR 261 (such as pH < 2.0 or >12.5 resulting in corrosively), and must be taken into account. The Contractor shall assume that a full scan TCLP analysis be performed for each sample collected.

3. Waste Storage:

   a. Hazardous Waste: The Contractor shall comply with EPA 40 CFR 262 for the on-site handling and storage of all waste deemed hazardous generated by the project. TCLP testing of the initial containers of debris shall be completed immediately upon filling. Until the TCLP test results are received, the containers shall be labeled as lead-containing debris. Hazardous waste labels shall be applied after the test results are received, if the debris tests hazardous for the items listed herein. Hazardous waste shall not be stored at the project site for more than 90 days. Special attention shall be given to the time of storage, storage conditions, amount of material stored at any one time, use of proper containers, and personnel training. Different types of hazardous waste shall not be co-mixed (e.g., do not mix clothing with paint debris). Hazardous waste shall not be placed on the unprotected ground, shall be located in a secure area enclosed by a fence with signs around the perimeter, and shall be shielded adequately to prevent dispersion of the waste by wind or water. Under no circumstances shall the waste be stored within a flood plain area. Any evidence of improper storage shall be cause for immediate shutdown of the project until corrective action is taken.
   b. Non-Hazardous Waste: Non-hazardous waste shall be stored separate from hazardous waste storage areas. Non-hazardous waste shall not be stored at the project site for more than 90 days.

4. Waste Transportation:

   a. Hazardous Waste: All hazardous waste shall be transported by a licensed transporter in accordance with EPA 40 CFR 263 and local regulations. The name, address, and qualifications of the licensed waste transporter shall be provided to the City for acceptance.
   b. Non-Hazardous Waste: All non-hazardous waste shall be transported in accordance with local regulations regarding waste transportation.

5. Waste Disposal:

   a. Hazardous Waste: The Contractor is responsible for assuring the proper disposal of all hazardous waste generated during the project. All hazardous waste shall be disposed of in accordance with 40 CFR 264 and 40 CFR 268. Only licensed TSD facilities shall be used. The name, address, and qualifications of the TSD facility shall be provided to the City for acceptance.
   b. Non-Hazardous Waste: The Contractor is responsible for the proper disposal of all non-hazardous waste generated during the project.
   c. Waste Resulting from the Use of Recycled Steel Grit Abrasives: When recycled steel grit abrasives are used, the waste disposal facility shall be notified that the waste contains lead and that further stabilization is required prior to disposal. The requirements for hazardous waste disposal shall also apply.

6. Contingency Plan and Training: The Contractor shall comply with EPA 40 CFR 265, Subpart C in the event of a spill or release of waste, EPA 40 CFR 265 Subpart D. All

personnel associated with the handling of hazardous waste shall complete a formal training program in accordance with 40 CFR 256.16, 29 CFR 1910.1200 regulations. Training records of all employees must be maintained and kept on file.

7. Manifest and Reporting:

   a. The Contractor shall comply with all of the manifesting, certification, and reporting requirements of EPA 40 CFR 262 and 40 CFR 268 including certificates of final disposal for each shipment.
   b. Copies of all records and reports, test sample chain of custody forms, and TCLP test results shall be provided to the City.

8. Decontamination:

   a. The Contractor shall thoroughly vacuum, wash, or otherwise decontaminate reusable items prior to removal from the project site. Items include, but are not limited to equipment, containment materials, ground covers, scaffolding, and change and shower facilities.
   b. If adequate cleaning is not possible, the materials shall be treated as waste and tested and disposed of in accordance with the requirements of this specification.

3.03 MERCURY

A. Personal Protective Equipment

1. The Contractors' personnel shall be equipped with and use all personal protective clothing and equipment necessary to safely handle product waste containers. Use of personal protective clothing and equipment shall be consistent with requirements and recommendations of the Occupational Safety and Health Administration (OSHA), the EPA, and/or the recommendations of the Program Manager. The minimum level of personal protective equipment required in the handling of waste containers shall include chemical resistant gloves, safety shoes or boots, a work uniform, and appropriate eye protection. All such equipment shall be supplied and properly maintained by the Contractor.

B. Handling, Packaging, and Transportation

1. Fluorescent lamps shall be assumed to contain mercury and handled according to 40 CFR 273.
2. Shipping records (bills of lading for fluorescent lamps) must be kept and submitted.
3. Any materials meeting the definition of a hazardous waste (40 CFR 261) that are to be disposed of must be disposed of in accord with all applicable Federal and City regulations

C. Treatment, Disposal, and/or Recycling

1. Recycling is encouraged.
2. Mercury lamps shall be recycled in accord with 40 CFR 273.

END OF SECTION

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All demolition, removal, salvage and disposal of existing structures, equipment, piping, electrical and materials.

1.02 STANDARD OF QUALITY

A. The Contractor is to provide all labor, materials and equipment required to complete demolition work.

B. All demolition work is to be done in a neat manner, consistent with the best acceptable industry practices and with full protection of adjacent construction or areas during the entire period of demolition.

C. Demolition work is to include the removal of permanent construction materials which are existing, and includes but is not limited to pavement, curbing, sidewalks, fencing, underground utilities or foundations, concrete, metal, masonry, wood, piping, equipment or materials of like intent.

D. Demolition work is to include the removal of existing materials which may interfere with the proper construction of new work regardless of whether noted on the Drawings or specified. Demolition work is to also include the reinstallation of any items of work which may have to be removed on a temporary basis, prior to demolition operations, in order to allow for the proper construction of new work.

1.03 SITE CONDITIONS

A. Protection

1. Erect barriers, fences, guardrails, enclosures, chutes, and shoring to protect personnel, structures, and utilities remaining intact.
2. Protect designated trees and plants from damage.

B. Maintaining Traffic

1. Assure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.

C. Utility Lines and Services

1. Keep existing structures to remain and adjacent structures intact and in operation.

2. Obtain permission to disrupt any utilities or services temporarily or permanently.

D. Prior to demolishing a utility or facility, the Contractor shall notify the City three days in advance and shall plan the demolition such that the demolition will not create an unsafe condition or interfere with ongoing operations.

E. Where demolition must occur in such a sequence that a portion of this facility must remain operational, the Contractor shall coordinate this aspect with the City.

F. Do not burn waste material on-site.

1.04 GOVERNING STANDARDS

A. All demolition and disposal work shall be in accordance with all rules, regulations and requirements of the Montgomery County Board of Health, MDE and all other local and state agencies having jurisdiction.

B. All local ordinances associated with demolition and disposal are to be complied with. Ordinances associated with noise or dust control related to demolition are to be complied with.

C. The Contractor is to furnish and pay for all licenses and permits. The Contractor is to arrange for and make all inspections and tests required by the governing authorities and agencies having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crates

1.	Floors:	4 x 4 No. 2 construction grade lumber
2.	Slats:	2 x 4 No. 2 construction grade lumber
3.	Polyethylene film:	6 mil, minimum, clear

B. Storage Oil: Shell VSI No. 33, or equal

C. Rust-Preventive Compound: Houghton "Rust Veto 344", "Rust-Oleum T-9", or equal

PART 3 – EXECUTION

3.01 STANDARD REQUIREMENTS

A. In general, demolition materials are not to be used as backfill, but are to be transported and disposed of in an approved off-site disposal area.

B. Materials such as concrete or masonry will not be acceptable as backfill.

C. Burning of demolished and/or removed materials is not permitted.

D. The Contractor is to conduct demolition work and the disposal of debris in such a manner so as to ensure a minimum interference with streets, walks, and other adjacent occupied structures. He is not to obstruct occupied or used facilities.

E. Demolition work is to be undertaken to completion, irrespective of whether or not it is precisely defined as to limits and quantities. If such demolition is required in order to complete the intended new construction, it is to be undertaken completely and without dispute.

F. The Contractor is to review the Drawings and Specifications to determine the extent of the work. The Contractor is specifically alerted to requirements for inspection of existing field conditions. The Contractor is to visit and inspect the project prior to preparing his bid in order to completely familiarize himself with all field conditions; the intent of the design, and the extent of all work. After his review and inspection is complete, and before he submits his bid, if the Contractor has any questions regarding the extent and details of the work under this section, he is to request, in writing, clarification from the Engineer.

G. Before proceeding with any work, the Contractor is to confirm methods of construction, obtain all required field measurements, and verify all dimensions on the Drawings as required.

H. Failure of the Contractor to familiarize himself with all drawings, relating to the work, and conditions existing at the site of construction, will not relieve him of his obligation to furnish all material and labor necessary to carry out the provisions of the contract documents and to complete the contemplated work for the consideration set forth in his bid.

I. The Contractor is alerted to the fact that the City assumes no responsibility for actual conditions of the areas indicated to be demolished and/or abandoned.

J. The Contractor shall refer to Section 01 40 00 and Contract Drawings for additional requirements regarding demolition, sequencing of work, and scheduling.

K. Conditions existing at the time of inspection for bidding purposes will be maintained by the City in so far as practicable.

L. The City shall have first right of refusal for all materials and equipment to be removed.

M. Storage or sale of demolished, removed, and/or discarded materials is not to be permitted on the site.

N. The Contractor shall protect adjacent facilities and is to promptly repair all damages caused to adjacent existing facilities by demolition operations at no cost to the City. All adjacent areas and existing facilities are to be restored to at least the condition existing prior to the start of the work, unless the Drawings indicate otherwise.

O. The use of explosives is not to be permitted.

P. Masonry and concrete, intended to be removed, is to be removed in small sections.

Q. All new openings are to be neatly cut using a carborundum wheel or a saw blade producing clean and sharp edges. All new openings are to have their masonry sides patched, repaired and made ready to a condition proper for the installation of new work.

R. The Contractor is to provide shoring, bracing or support to prevent movement, settlement or collapse of construction and/or work to be removed and adjacent facilities to remain.

S. All demolition work is to be done in a neat manner, consistent with the best acceptable industry practices and with full protection of adjacent construction or areas during the period of demolition.

T. All finish surfaces are to be workmanlike in appearance and uniform in color. Surfaces are to be straight, true and satisfactory to the Engineer.

U. Upon completion of the demolition work, the Engineer will make an inspection of the work. No new work is to be started until the demolition work has been approved by the Engineer.

V. All work is to be coordinated so that new work can begin immediately after the demolition work has been completed.

W. The Contractor is to submit a schedule of proposed dates and proposed methods and operations for demolition and/or removal work to the Engineer for review prior to the start of the work. The method of demolition and/or removal is to be such as not to damage any portion of the work or building to be retained, or damage the structural integrity thereof. Included in this schedule is to be the coordination for shut-off, capping, and the discontinuation or continuation of utility services, and the methods to be used for all aspects of demolition and removal work.

X. No demolition and/or removal work is to be undertaken until the schedules have been reviewed by the Engineer and the City.

Y. The Contractor is to proceed with all work in a systematic manner. The Contractor is to cut and remove all unwanted construction by methods least likely to damage adjacent work or work intended to be retained.

3.02 EXAMINATION

A. Verify that areas to be demolished are unoccupied and discontinued in use.

B. Do not commence work until conditions are acceptable to City.

3.03 PREPARATION

A. Arrange for and verify termination of utility services to include removing meters and capping lines.

B. Remove items scheduled to be salvaged and place in designated storage area.

3.04 DEMOLITION

A. Sprinkle debris and use temporary enclosures as necessary to control dust.

B. Do not use water to the extent it causes flooding, contaminated runoff, or icing.

C. Break concrete and masonry into sections less than 3 FT in any dimension.

D. Repair damage to adjacent structures.

E. Make neat saw cuts, 1 IN in depth, around areas of concrete to be removed, where remaining concrete is to be incorporated into new work.

F. Remove existing exposed piping and electrical wiring and conduit to be abandoned from structural surface, cut flush, and finish to match existing surfaces.

G. Removal of Existing Structures

1. Remove portions of existing structures as indicated on Drawings or otherwise specified.
2. Any demolition occurring over an existing structure to remain, or over a structure containing liquid shall be done in such a manner that any or all items demolished will not fall, causing damage to structure below or into liquid and possibly damaging equipment.

H. Removal of Existing Equipment

1. Demolish existing monorail and ancillary support structures. Salvage existing electric crane and return to City.
2. All equipment to be removed or replaced shall be done so in a safe manner and such that the equipment and any associated piping or wiring is not damaged.
3. All equipment specified for reuse shall be stored as directed by the City.
4. Not specified for reuse, existing equipment becomes property of the Contractor.

5. Materials and equipment not required for reuse at the plant site but to be retained by the City shall be marked or designated by the City.
6. All materials and equipment designated to be retained shall remain the property of the City.
7. City shall have first right of refusal for all materials and equipment.

I. Pipe Penetration Demolition

1. For pipes and conduit larger than 12 IN installed through existing walls and slabs, provide demolition of opening as required at locations shown.
2. For pipe and conduit 12 IN and smaller installed through existing walls and slabs, demolish as required to provide penetration required.
3. See Drawing Details for penetration requirements.

J. Electrical Materials and Equipment

1. Existing pad mounted equipment that is scheduled to be removed or relocated during construction shall have its pad removed and any existing conduit removed to below finished grade.
2. Existing electrical materials and equipment, including but not limited to lighting fixture, wiring devices, signal equipment, conduit and wires, and all other electrical items which are rendered obsolete by these alterations and additions, shall be disconnected at source and removed.
3. Electrical equipment shall be temporarily removed by the Contractor as required to facilitate contract work and restored upon installation of new facilities.

K. Protection of Adjacent Facilities

1. All existing and new work is to be completely protected from damage and maintained satisfactorily during the Contractor's operations.
2. The Contractor is to provide adequate protection of other work during his operations to prevent damage or detrimental effects which may arise from general exposure, adverse weather, adjacent construction operations, or activities at the work location.
3. The Contractor is to execute demolition work so that adjacent property is protected against damages which might occur from falling debris or other causes. The Contractor is not to interfere with the use of adjacent buildings and is to maintain free and safe passage to and from such buildings.
4. The Contractor is to take all precautions to guard against the movement, settlement or collapse of any sidewalks or street passages of adjoining property and is liable for any movement, settlement or collapse.

L. Repair Work

1. The Contractor is to promptly repair all damage done to the City's property or any other person, or persons on or off the premises by reason of his demolition work.
2. The Contractor is to clean all adjacent structures and improvements of dust, dirt and debris caused by his demolition operations.
3. The Contractor is not to store, or permit debris to accumulate on the site. If the Contractor fails to remove excess debris after more than 48 hours and after written notification by the City to the Contractor for said removal, the City reserves the right to cause such debris to be removed at the Contractor's expense. Costs incurred by the City are to be deducted from the payment to be made to the Contractor.
4. In the course of the demolition work, where indicated the Contractor will be required to clean existing structures prior to backfilling. For the cleaning of structures, the Contractor shall hose down the walls and floor and remove all residual material such that the surfaces are clean and free of residuals, to the satisfaction of the engineer.
5. Upon completing demolition work, the Contractor shall regrade the areas where existing facilities were demolished. The Contractor is to provide imported fill conforming to these specifications, if required, to backfill existing structures to be demolished. After demolition, the Contractor shall restore all areas and structures to be demolished in accordance with these specifications.
6. The Contractor is alerted to the fact that some of the demolition work will involve work in confined spaces. The Contractor is responsible for complying with all OSHA and MDE requirements when conducting work in confined spaces.

M. Cleanup

1. The Contractor is to clean all adjacent structures and improvements of dust, dirt and debris caused by his demolition operations.
2. The Contractor is not to store, or permit debris to accumulate on the site. If the Contractor fails to remove excess debris after more than 48 hours and after written notification by the City to the Contractor for said removal, the City reserves the right to cause such debris to be removed at the Contractor's expense. Costs incurred by the City are to be deducted from the payment to be made to the Contractor.

3.05 HAZARDOUS MATERIALS

A. If suspected hazardous materials are encountered during demolition of existing facilities, all work is to be terminated immediately and the City is to be immediately notified.

3.06 DISPOSAL

A. Remove demolition debris daily.

B. Transport demolition debris to on-site disposal area.

C. Remove demolition debris from site to approved disposal facility at minimum of 2-week intervals.

END OF SECTION

SECTION 02 92 00
LANDSCAPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work included in this section shall cover the stripping, stockpiling and replacement of any existing topsoil throughout the site, the furnishing and placement of additional topsoil as required to provide a 6-inch covering throughout the area to be grassed, restoration of disturbed areas to their original condition, the furnishing and spreading of lime, fertilizer, and other surface treatment required for the growth of grass, and the cutting and water of such grass as hereinafter specified.

B. The Contractor may furnish and place sod in lieu of providing seed at no additional charge to the City.

C. Topsoil, if any, taken from original excavations shall be carefully and separately stored, and after completion of the rough grading, shall be spread, graded, and rolled to conform with the elevations shown on the Contract Drawings. Additional topsoil, as required, shall be furnished by the Contractor at no additional cost. A minimum thickness of topsoil of six (6) inches will be required in all areas to be seeded.

D. All work performed and materials furnished shall conform to the lines, grades, cross-sections, dimensions, details, gradation and physical requirements indicated on the Contract Drawings and as called for in the Specifications. The Engineer will be assisted in inspection of all work performed and materials furnished under this section by a qualified Soils Engineer, licensed in the Commonwealth of Maryland.

E. The Contractor during all phases of his work shall carefully protect all existing structure, pipelines, drains, conduits, or other improvements on the site, and shall restore same to a condition equivalent to conditions existing prior to his operations. Ample precautions shall be taken to prevent settlement of existing improvements.

F. All existing pipelines and services shall be maintained or, where required, shall be removed and replaced to accommodate the work to be done under this Contract.

PART 2 - PRODUCTS

2.01 SEEDING

A. Topsoil shall not contain more than 40 percent clay in that portion passing a No. 10 sieve and shall contain not less than 5 percent or more than 20 percent organic matter as determined by loss of ignition of samples oven-dried to constant weight at 212 degrees Fahrenheit.

B. Fertilizer is to be lawn or turf grade and applied at a rate of 500 lbs/acre of 12-12-12 or equivalent. Limestone is to be applied at a rate of 2 tons/acre and fertilizer is to be worked into a depth of 4-inches.

C. Seed to be furnished under this section shall be composed of the following Permanent Seeding Schedule:

Kind of Seed	**Planting Rate (lbs)**		**Optimal Planting Period**	**Acceptable Planting Period**
	Per Acre	**Per 1,000 SF**		
Stabilize Wetland Areas				
1. Perennial Rye Grass	---	2	Fall	Fall or Spring
2. Reed Canary Grass	---	2		
3. Red Top	---	1/8		
Stabilize Transition Areas and Non-Wetland Areas				
1. Hard Fescue	120	---	Fall	Fall or Spring
2. Creeping Red Fescue	29	---		
3. Perennial Rye Grass	11	---		

G. The seed shall contain practically no seeds of noxious weeds and shall be delivered mixed in uniform sealed bags showing weights, analysis, and vendor's name.

H. Less application rates of fertilizer or seed or variations from fertilizer composition or seed type will be permitted only with the recommendations from the local Soil Conservation District Office after completion of a soils analysis.

I. Seeds shall be 98% pure and are to be planted in accordance with the requirements of the Montgomery County Conservation District.

PART 3 - EXECUTION

3.01 TOPSOILING

A. Topsoil shall be replaced with adequate amounts of topsoil material to restore the disturbed area to its original, pre-disturbance grade and depth of soil.

B. All stockpiled existing topsoil shall be thoroughly cleared of all sticks, roots, branches, coarse sods, and other deleterious matter, and all stones larger than one inch in diameter before it is re-spread.

C. New topsoil furnished from sources outside the site shall have a minimum organic content of not less than 2.75 percent by weight which shall be guaranteed by the supplier of the topsoil. New topsoil shall be of good quality and approved by the Engineer. All new topsoil shall be from the same source.

D. Topsoil shall not be handled or spread when it is in a frozen or muddy condition or otherwise unsuitable for handling.

E. No topsoil shall be spread before completion of all construction in the area or before all fills are fully stabilized.

F. Before spreading topsoil, the subgrade shall be cleared of all stones more than two inches in diameter, all coarse roots, sticks, and debris to a depth of 4 inches. Any portions of the subgrade which have been compacted to a hard surface shall be pulverized and cultivated to a depth of four inches by plowing, disk harrowing, or other satisfactory method. Immediately prior to topsoil distribution the surface shall be scarified to provide a good bond with the topsoil.

3.02 SEEDING

A. All areas to be seeded shall then be fine graded to remove all ridges and depressions, and the surface shall be cleaned of all stones greater than one inch in diameter, and other debris.

B. After preparation of the seed bed, and at least nine days before seeding, an approved commercial complete fertilizer with a minimum content of 10% nitrogen, 20% phosphoric acid, and 10% potash shall be incorporated into the soil at a rate of 500 lbs/acre to a depth of 4-inches, as detailed within the above Section 2.1.3. The soil shall then be thoroughly watered.

C. Seed shall then be evenly spread and raked into the prepared soil at the rates indicated within the table in Section 2.01. Seed shall be rolled with a water ballast roller and shall be watered, protected by and tended by the Contractor until there is a hardy stand of grass. Areas not thus productive shall be refertilized and reseeded as above until grass is established. All seeded areas shall be immediately mulched with hay uniformly

spread in a layer 1 to 1-1/2 inch thick, loose measurement. Hay shall be blown on in its natural length. Chopped hay shall not be used. No seeded areas shall remain unmulched longer than 5 days. Mulch nettings of jute or excelsior matting shall be used during colder months to protect slopes. After mulching, Contractor shall apply mulch binder consisting of one application of a biodegradable, non-phytotoxic tackifier at a rate as recommended by the manufacturer and approved by the Engineer. All mulch shall be left in place to disintegrate except that Contractor shall remove excessive amounts of hay when so directed by the Engineer.

D. Seeded areas that erode during the Contract period (including the year's maintenance and repair period) shall be repaired and restored by the Contractor in accordance with all provisions of this Section of the Specifications.

E. Dates and schedules for seeding operations shall be as approved by the Engineer. Seeding shall be done in favorable weather, in the fall where possible, and in early spring if necessary to complete unfinished areas.

3.03 SODDING

A. Sodding operations shall not be undertaken until all other construction work and clean-up operations have been completed. Sodding shall be done during time of favorable growing periods such that at least two (2) cutting operations can be undertaken by the Contractor.

B. Sod shall be placed within 24 hours after stripping and be protected against drying and breaking of the rolled strips.

C. Sod shall be obtained from a competent nursery with at least five (5) years' experience. The Contractor shall provide the Engineer with the name of the sod supplier for approval prior to order and placement of such material.

D. Sod shall be comprised of approximately 25% Kentucky Blue Grass. The balance of the sod shall be comprised of approximately 15% Red Top grass, 45% domestic-grown chewings Fescue, and 15% Astoria Bent. Sod shall be strongly rooted, be not less than two (2) years old, and be free of weeds and undesirable native grasses. All sod shall be capable of growth and development when planted. Sod shall be of uniform thickness, approximately 5/8 inch (excluding top growth) at time of cutting.

E. No sod shall be placed on frozen ground. All sod shall be supplied in rows of 12" width by 48” in length. Sod shall be placed on the contour such that alternate rows will have staggered joints with all edges butted tight to adjacent sod pieces. Sod shall be lightly tamped or rolled to ensure contact with the subgrade. Broken or torn pads will not be acceptable.

F. Immediately after placing the sod, the Contractor shall fertilize the sod with 5-10-5 applied at a rate of 600 lbs/acre. Fertilizer shall be combined with a thin layer of

topsoil spread evenly over the sodded area to a smooth uniform surface. Along the crown of the slope a capping strip of jute or plastic netting properly secured shall be used to prevent undercutting of the sod. The Contractor is responsible to maintain (cutting, watering, etc.) the lawn until the project completion date and acceptance by the City and provide no less than two cuttings.

3.04 FERTILIZING

A. After topsoil is in place, the Contractor shall take a minimum of five (5) soil samples at various points designated by the Engineer and shall submit them to the local Soil Conservation District Office or other designated agency for analysis and pH determination. After the pH value of the topsoil is thus determined, the Engineer shall recommend the rate of limestone application to bring the pH to 6.5. The cost of the limestone addition is to be included in the lump sum bid price.

B. Ground limestone shall be evenly applied by the Contractor to all areas to be seeded at the rate specified by the Engineer and shall be thoroughly and evenly mixed with the soil to a depth of 5 inches below finished grade.

C. After preparation of the seedbed, and at least nine days before seeding, an approved commercial complete fertilizer with a minimum content of 10% nitrogen, 20% phosphoric acid, and 10% potash shall be incorporated into the soil at a rate of 500 lbs/acre and worked to a depth of 4-inches. Lime is to be applied at a rate of 2 tons/acre and worked to a depth of 4-inches. The soil shall then be thoroughly watered.

3.05 CUTTING LAWNS

A. The Contractor shall also be held responsible for a minimum of two (2) cuttings of all lawns. Any lawn areas which have not developed after two (2) cuttings shall be cut until a full lawn is produced.

B. The cuttings of lawn shall not occur closer than 5 to 7 days, or a directed by the Engineer.

C. If a full lawn is produced prior to the project completion date, the Contractor is responsible to maintain (cutting, watering, etc.) the lawn until the project completion date.

3.06 WATERING LAWNS

A. The Contractor shall take all necessary steps to produce a satisfactory lawn covering and shall water the new lawn until it has received its second cutting.

B. The cost of such watering shall be borne by the Contractor, and the equipment and manpower required shall be furnished by the Contractor.

C. If a full lawn is produced prior to the project completion date, the Contractor is responsible to maintain (cutting, watering, etc.) the lawn until the project completion date.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Description of scope and intent:

1. Contractor to provide all material, labor, and tools required to complete the installation of specified system.
2. Any omission of reference to items required to complete the full operational and functional system specified in the section does not relieve the contractor of the obligation to provide same.
3. To provide installation of all items, including delivery, dispersing to the proper locations within the building, and affixing in place.
4. Installation shall be accomplished by workers skilled in their craft who will perform their work in a professional manner and will leave the premises safe, orderly and clean.
5. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section
6. Contractor is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permits, fees and services necessary for completion of work in this section.

B. Section Includes:

1. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
2. Formwork accessories.
3. Form stripping.
4. Reinforcing steel for cast-in-place concrete.
5. Cast-in-place concrete, including concrete for the following:

    a. Foundations, footings.
    b. Slabs on grade.
    c. Supported slabs.
    d. Foundation walls.
    e. Building frame members.
    f. Equipment pads and bases.
    g. Reinforced masonry.
    h. Flowable Fill

6. Concrete curing.
7. Shoring and Reshoring.

C. Related Sections:

1. Special concrete finishes: Elsewhere in Division 3.
2. Joint sealers: Division 7.

1.02 REFERENCES

Comply with the following documents, except where requirements of the Contract Documents or of governing codes and governing authorities are more stringent. All referenced standards refer to the edition in force at the time these plans and specifications are issued.

A. AASHTO M 182 -- Standard Specification for Burlap Cloth Made from Jute or Kenaf; American Association of State Highway and Transportation Officials.

B. ACI 117 -- Standard Tolerances for Concrete Construction and Materials; American Concrete Institute.

C. ACI 201.2R -- Guide to Durable Concrete; American Concrete Institute.

D. ACI 207.1R – Mass Concrete, American Concrete Institute

E. ACI 207.2R – Effect of Restraint, Volume Change, and Reinforcement on Cracking of Mass Concrete, American Concrete Institute

F. ACI 207.4R – Cooling and Insulating Systems for Mass Concrete

G. ACI 211.1 -- Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.

H. ACI 224R – Control of Cracking in Concrete Structures, American Concrete Institute

I. ACI 232.1R – Use of Raw or Processed Natural Pozzolans in Concrete, American Concrete Institute

J. ACI 232.2R – Use of Fly Ash in Concrete, American Concrete Institute

K. ACI 301 -- Specifications for Structural Concrete for Buildings; American Concrete Institute.

L. ACI 302.1R -- Guide for Concrete Floor and Slab Construction; American Concrete Institute.

M. ACI 304R -- Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.

N. ACI 305R -- Hot Weather Concreting; American Concrete Institute.

O. ACI 306R -- Cold Weather Concreting; American Concrete Institute.

P. ACI 308R – Guide to Curing Concrete, American Concrete Institute

Q. ACI 309R – Guide to Consolidation of Concrete, American Concrete Institute

R. ACI 318 -- Building Code Requirements for Reinforced Concrete; American Concrete Institute.

S. ACI 350/350R – Code Requirements for Environmental Engineering Concrete Structures and Commentary, American Concrete Institute

T. ACI SP-66 -- ACI Detailing Manual; American Concrete Institute.

U. ASTM A 185 -- Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

V. ASTM A 615 -- Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

W. ASTM C 31 -- Standard Practice for Making and Curing Concrete Test Specimens in the Field.

X. ASTM C 33 -- Standard Specification for Concrete Aggregates.

Y. ASTM C 39 -- Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

Z. ASTM C 42 -- Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

AA. ASTM C 94 -- Standard Specification for Ready-Mixed Concrete.

BB. ASTM C 143 -- Standard Test Method for Slump of Hydraulic Cement Concrete.

CC. ASTM C 150 -- Standard Specification for Portland Cement.

DD. ASTM C 171 -- Standard Specification for Sheet Materials for Curing Concrete.

EE. ASTM C 172 -- Standard Practice for Sampling Freshly Mixed Concrete.

FF. ASTM C 173 -- Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

GG. ASTM C 231 -- Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

HH. ASTM C 260 -- Standard Specification for Air-Entraining Admixtures for Concrete.

II. ASTM C 494 -- Standard Specification for Chemical Admixtures for Concrete.

JJ. ASTM C 618 -- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

KK. ASTM C 685 -- Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

LL. ASTM C 881 -- Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

MM. ASTM C 1059 -- Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

NN. ASTM C 1107 -- Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

OO. ASTM D 1751 -- Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

PP. ASTM D 1752 -- Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

QQ. ASTM E 154 -- Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.

RR. ASTM E 329 -- Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

SS. CRSI -- Manual of Standard Practice; Concrete Reinforcing Steel Institute.

TT. FBC, Building -- Florida Building Code, Building

1.03 DEFINITIONS

A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.

B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view except those indicated to receive textured finish, and including surfaces which may receive a paint coating (if any).

C. Textured Finish: An exposed architectural finish achieved by means of form liners or special construction of the formwork.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for the following:
   1. Formwork accessories.
   2. Form liners.
   3. Concrete admixtures.
   4. Grout.
   5. Bonding compound.
   6. Epoxy bonding system.

B. Aggregates: Submit test reports showing compliance with specified quality and gradation.

C. Shop Drawings: Submit shop drawings for fabrication and placement of the following:

   1. Reinforcement: Comply with ACI SP-66. Include bar schedules, diagrams of bent bars, arrangement of concrete reinforcement, and splices.

      a. Show construction joints.
      b. Include details of reinforcement at openings through concrete structures.
      c. Include elevations of reinforcement in walls.
      d. Show stirrup spacing.
      e. Concrete embedments.

   2. Shoring and reshoring for elevated concrete placement shall include:

      a. Location, size, and type of all shoring members.
      b. Location, size, and type of all reshoring members.
      c. Location, size, and type of all mud sills, blocking, temporary lateral bracing and other accessories necessary to safely support and brace the structure during construction.
      d. Prepare shop drawings under seal of professional structural engineer registered in the state in which the project is located.

D. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

   1. Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected.

      a. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength f(cr).
      b. Indicate quantity of each ingredient per cubic yard of concrete.
      c. Indicate type and quantity of admixtures proposed or required.

   2. Test reports: Submit laboratory test reports for all testing specified.
   3. Certifications: Submit affidavits from an independent testing agency certifying that all

materials furnished under this section conform to specifications.

4. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
5. Certifications: Submit mill test certificates for all reinforcing steel furnished under this section, showing physical and chemical analysis.
6. Placement schedule: Submit concrete placement schedule prior to start of any concrete placement operations. Include location of all joints indicated on drawings, plus anticipated construction joints.
7. Cold weather concreting: Submit description of planned protective measures.
8. Hot weather concreting: Submit description of planned protective measures.
9. Mass Concrete: Submit description of planned protective measures.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following documents, except where requirements of the contract documents or of governing codes and governing authorities are more stringent:

1. ACI 350/350R
2. ACI 301
3. ACI 318
4. CRSI Manual of Standard Practice

B. Testing Agency Services:

1. Employ, at contractor's expense, an independent testing agency acceptable to the engineer to perform specified tests and other services required for quality assurance.

    a. Testing agency shall meet ASTM E 329 requirements.

C. Source of Materials: Obtain materials of each type from same source for the entire project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement drawings.
    1. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.

B. Store cementitious materials in a dry, weather tight location. Maintain accurate records of shipment and use.

C. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

D. Handle aggregates to avoid segregation.

1.07 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306.

1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.

B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 305R.

1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and windbreaks.

C. Mass Concrete: Comply fully with the recommendations of ACI 207.1R.

1. Well in advance of proposed concreting operations, advise the engineer of planned protective measures including but not limited to cooling of materials before or during mixing, placement, curing, forms, height of lifts (max 10ft), and monitoring.

PART 2 – PRODUCTS

2.01 FORMWORK

A. Facing Materials:

1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete.
2. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances, and as follows:

    a. Custom form liner: see Architectural drawings.

3. Textured finish concrete: Materials or linings as indicated on the drawings, or as required to match architect's control sample.

B. Formwork Accessories:

1. Form coating: Form release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch-diameter hole in concrete surface.

3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: Provide deformed bars complying with the following, except where otherwise indicated:

1. ASTM A 615, Grade 60.

B. Welded Wire Fabric: ASTM A1064, cold-drawn steel, plain.

C. Reinforcing Accessories:

1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice".

a. Class 1 (plastic protected) at all formed surfaces which will be exposed to weather.
b. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.
c. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.
d. Plastic chairs shall not be used.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, and as follows:

1. Type I, except where other type is specifically required below or noted elsewhere in the Contract Documents.

a. Type II shall be used for moderate sulfate resistance, retaining walls and exposed concrete not included in Type V below and when hot weather concreting is required.
b. Type III shall be used for high early strength and when cold weather concreting is required.
c. Type IV shall be used for low heat of hydration when mass concreting is required.
d. Type V shall be used for high sulfate resistance and in all environmental (includes all wet well surfaces) and all liquid retaining structures.

B. Fly Ash: ASTM C 618, Type C or F.

C. Water: Potable.

D. Aggregates:

1. Normal weight concrete: ASTM C 33.

a. Class 5M.
b. Gradation as specified below under mix design.

E. Admixtures - General: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.

F. Air-Entraining Admixture: ASTM C 260 and certified by manufacturer for compatibility with other mix components.

G. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

H. Water-Reducing and Accelerating Admixtures: ASTM C 494, Type E.

I. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.

J. Crystalline Waterproofing Admixture:

1. Products: The following products, provided they comply with requirements of the contract documents, will be among those considered acceptable:

a. Xypex C series admixtures or equivalent.

K. Ground Granulated Blast-Furnace (GGBF) Slag: ASTM C-989, Grade 120.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Vapor Retarder: Membrane for installation beneath slabs on grade, reference:

1. Provide as specified under Section 07265, Underslab Vapor Protection.

B. Nonshrink Grout: ASTM C 1107.

1. Type: Provide nonmetallic type only.

C. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

D. Moisture-Retaining Cover: ASTM C 171, and as follows:

1. Curing paper.
2. Polyethylene film.
3. White burlap-polyethylene sheeting.

E. Bonding Compound: Non-redispersable acrylic bonding admixture, ASTM C 1059, Type II.

F. Epoxy Bonding Systems: ASTM C 881; type, grade, and class as required for project conditions.

G. Expansion Joint Filler:

3. Nonextruding bituminous type: ASTM D 1751.
4. Sponge rubber type: ASTM D 1752, Type I.
5. Cork type: ASTM D 1752, Type II.
6. Self-expanding cork type: ASTM D 1752, Type III.

H. Waterstops: Made of Polyvinyl Chloride (PVC) and of subzero grade, Plastigrip, Type W-6 as manufactured by Progress Unlimited, Inc. or approved equivalent.

1. Minimum 4”x3/16” or as specified on the drawings.
2. Produced from a compound, the base resin of which shall be virgin PVC.
3. Minimum Properties:

a. 2000 psi minimum tensile strength, ASTM D412-51T
b. 350% minimum elongation, ASTM D412-51T
c. -35 degrees F minimum low temperature brittleness, ASTM D746-57T
d. 65-75 shore ‘A’ durometer hardness, ASTM D676-59T
e. 0.15 maximum water absorption, ASTM D570-59T

4. Field Splicing:

a. Butt splices shall be fused welded using a thermostatically controlled Teflon PVC Waterstop iron at the Manufacturer’s recommended temperature
b. Lapping, gluing or use of adhesives shall not be permitted.
c. Provide factory made waterstop fabrications for all changes of directions, intersections, and transitions leaving only butt joint splicing for the field.

5. Center waterstop in the joint and secure in correct position.
6. Use ribbed center bulb for all moving joints. Use dumbbell for all non-movement joints.
7. Always place the center bulb in the center of the expansion joint. Do not embed the center bulb in concrete.
8. Vibrate concrete around waterstops thoroughly to prevent honeycombing and to ensure contact between concrete and waterstop.

2.05 CONCRETE MIX DESIGN

A. Review: Do not begin concrete operations until proposed mix has been reviewed by the engineer.

B. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.

C. Required Average Strength: Establish the required average strength f(cr) of the design mix on the basis of trial mixtures as specified in ACI 301, and proportion mixes accordingly. Employ an independent testing agency acceptable to the engineer for preparing and reporting proposed mix design.

D. Proportion normal-weight concrete mix to produce an average strength at 28 day as indicated on the drawings.

E. Fly Ash:

1. The contractor may elect to replace a portion of the Portland cement with fly ash up to a maximum of 25 percent by weight of cement plus fly ash.

F. GGBF Slag

1. Maximum of 50 percent of weight of cement.

a. Percentage: Establish by

1) Importance of early strength.
2) Curing temperature involved.
3) Properties of other concrete materials.

b. Minimum percentage: Determine by performing ASTM C1260 test if alkali content of cement is higher than 0.6 percent, so expansion of test mortar does not exceed 0.1 percent
c. Minimum cement content and water to cement ratio: Determine on basis of combined weight of cement and GGBF slag.

G. Admixtures:

1. Air-entraining admixture: Add at rate to achieve specified air content.

a. Do not use in slabs-on-grade scheduled to receive topping, unless manufacturer of topping recommends use over air-entrained concrete.

2. Water-reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.
3. Water-reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.
4. High-range water-reducing admixture (superplasticizer): Add as required for placement and workability.
5. Crystalline waterproofing admixture. Add at a mix ration as required to produce concrete that complies with the specified requirements of this specification at the following locations. Admixture shall not decrease the compressive strength of the

concrete as specified.

a. Provide in all below grade concrete exposed to earth including foundation mat and all concrete located in the wet wells and vaults.

6. Do not use admixtures not specified or approved.

H. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water-cement ratio might result in strengths greater than the minimum specified; likewise, a greater cement content or lower water-cement ratio may be required in order to achieve the required strength.

1. Specified compressive strength f'(c) (ASTM C 39): As noted
2. Maximum water-cement ratio by weight:

a. 0.4 for below grade concrete exposed to earth, concrete located in wet wells, and concrete toppings subject to vehicular traffic
b. 0.45 for all other concrete

3. Maximum slump: As recommended in ACI 211.1.
4. Gradation of coarse aggregate: ASTM C 33 standard gradation with maximum nominal size of 3/4 inches.
5. Total air content (ASTM C 173 or ASTM C 231): 5 percent.
6. Maximum water soluble chloride ion content shall not exceed percent by weight of cement by 0.10.

I. Design flowable fill mix to meet or exceed the following requirements:

1. Specified compressive strength f'(c) (ASTM C 39): Minimum 125 psi
2. Minimum cement content: 75-150 lb/yd^3
3. Minimum water content: Adequate to produce a consistency that will result in a flowable, self-leveling product at time of placement.
4. Unit Weight: 100-120 lb/yd^3.
5. Fine Aggregate: Proportion to yield 1 yd^3.
6. Total air content (ASTM C 173 or ASTM C 231): 5-15 percent.

J. Mix Adjustments: Provided that no additional expense to owner is involved, contractor may submit for engineer's approval requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.06 CONTROL OF MIX IN THE FIELD

A. Slump: A tolerance of up to 1 inch above that specified will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used,

provided proper placing and consolidation is obtained.

1. If slump upon arrival at the site is lower than 1 inch below the value specified, one addition of water in accordance with ASTM C 94 will be permitted to bring slump within tolerance, provided that:

    a. A positive means is available to measure the amount of water added at the site.
    b. The specified (or approved) maximum water-cement ratio is not exceeded.
    c. Not more than 45 minutes have elapsed since batching.

B. Total Air Content: A tolerance of plus or minus 1-1/2 percent of that specified will be allowed for field measurements.

C. Do not use batches that exceed tolerances.

2.07 CONCRETE MIXING

A. On-Site Equipment: Mix concrete materials in appropriate drum type batch machine mixer, in compliance with ASTM C 685. Mix each batch minimum of 1-1/2 minutes and maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.

B. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.

1. At ambient temperatures of 85 to 90 degrees F, reduce mixing and delivery time to 75 minutes.
2. At ambient temperatures above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 CONCRETE FORM PREPARATION

A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.

B. Earth Forms: Hand-trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.

C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.

D. Construction: Construct and brace formwork to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.

1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.

   a. Align joints symmetrically at exposed conditions.

2. Chamfers: Provide chamfered edges and corners at exposed locations, unless specifically indicated otherwise on the drawings.
3. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.
4. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.

E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.

F. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Rust on form surfaces is unacceptable.

3.02 VAPOR RETARDER INSTALLATION

A. General: Place vapor retarder sheet over prepared base material as recommended by manufacturer.

3.03 PLACING REINFORCEMENT

A. General: Comply with requirements of ACI 301 and as herein specified.

B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.

C. Placement: Place reinforcement to achieve not less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.

1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.

2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.

D. Welding: Welding of reinforcement is not permitted.

3.04 JOINT CONSTRUCTION

A. Construction Joints: Locate and install construction joints as indicated on drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance, as acceptable to the engineer.

1. Keyways: Provide keyways not less than 1-1/2 inches deep.
2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
3. Provide waterstop in all joints below grade exposed to earth, wet wells, and all other elements exposed to water, sludge, etc.

B. Isolation Joints: Construct isolation joints in slabs poured on grade at points of contact with vertical components, such as foundation walls and column pedestals. Install expansion joint filler to full concrete depth. Recess top edge of filler 1/8 inch where joints are unsealed.

C. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant (and backer rod where necessary) specified in Division 7.

D. Control Joints: Construct contraction joints in slabs poured on grade to form panels of sizes indicated on drawings, but not more than 20 feet apart in either direction.

1. Saw cuts: Form control joints by means of saw cuts one-fourth the depth of the slab, performed as soon as possible after slab finishing without dislodging aggregate.

3.05 INSTALLATION OF EMBEDDED ITEMS

A. General: Set anchorage devices and other items required for other work connected to or supported by cast-in-place concrete, using templates, setting drawings, and instructions from suppliers of items to be embedded.

1. Edge Forms and Screeds: Set edge forms and intermediate screeds as necessary to achieve final elevations indicated for finished slab surfaces.

3.06 CONCRETE PLACEMENT

A. Preparation: Provide materials necessary to ensure adequate protection of concrete during inclement weather before beginning installation of concrete.

B. Inspection: Before beginning concrete placement, inspect formwork, reinforcing steel, and items to be embedded, verifying that all such work has been completed.

1. Wood forms: Moisten immediately before placing concrete in locations where form coatings are not used.

C. Placement - General: Comply with requirements of ACI 304 and as follows:

1. Concreting should be carried on at such a rate that the concrete is at all times plastic and flows readily into spaces between reinforcement.
2. Schedule continuous placement of concrete to prevent the formation of cold joints.
3. Provide construction joints if concrete for a particular element or component cannot be placed in a continuous operation.
4. Deposit concrete as close as possible to its final location, to avoid segregation.
5. Concrete shall be worked around reinforcement and embedded fixtures and into corners of forms.
6. The following shall be prohibited from use:

    a. Partially hardened concrete.
    b. Contaminated concrete.
    c. Re-tempered concrete.
    d. Re-mixed concrete after initial set has occurred.

D. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.

1. Consolidate concrete by means of mechanical vibrators, inserted vertically in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates.
3. Do not use vibrators to move concrete laterally.

E. Slab Placement: Schedule continuous placement and consolidation of concrete within planned construction joints.

1. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds, or other means acceptable to engineer.
2. Strike off and level concrete slab surfaces, using highway straightedges, darbies, or bull floats before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.

F. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.

1. Do not use frozen or ice-laden materials.
2. Do not place concrete on frozen substrates.

G. Hot Weather Placement: Comply with recommendations of ACI 305R when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.

1. Do not add water to approved concrete mixes under hot weather conditions.
2. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.
3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

H. Mass Concrete Placement: Comply with recommendations of ACI 207.1R when any volume of concrete with dimensions large enough to require that measures be taken to cope with generation of heat from hydration of the cement and attendant volume change to minimize cracking.

1. When the minimum dimension of the concrete exceeds 36 inches and the ratio of volume of concrete to the surface area is greater than 12 inches, provide for mass concrete.
2. Lifts shall not exceed 10ft.

3.07 FINISHING FORMED SURFACES

A. Repairs, General: Repair surface defects, including tie holes, immediately after removing formwork.

1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.

B. Textured Form Finish: Repair tie holes and patch defective areas to match pattern created by form construction or form liners.

C. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding 1/4 inch height.

D. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.

1. Smooth rubbed finish: Apply to surfaces no later than 24 hours after form removal.

    a. Wet concrete surfaces to be finished and rub with Carborundum brick or other abrasive until uniform color and texture are achieved.
    b. Do not apply separate grout mixture.

2. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaces adjacent to or contiguous with formed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.

3.08 FINISHING SLABS

A. Finishing Operations - General:

1. Do not directly apply water to slab surface or dust with cement.
2. Use hand or powered equipment only as recommended in ACI 302.1R.
3. Screeding: Strike off to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic.
4. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate. Recheck and correct surface tolerances.
5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than 1/4-inch indentation or weight of power floats without damaging flatness.
6. Final floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.

B. Coordinate appearance and texture of required final finishes with the architect before application.

1. Apply final finishes in the locations indicated on the drawings.

C. Float Finish: As specified above.

D. Broomed Float Finish: After floating and when water sheen has practically disappeared, apply uniform transverse corrugations approximately 1/16 inch deep, without tearing surface.

E. Slab Surface Tolerances:

1. Achieve flat, level planes except where grades are indicated. Slope uniformly to drains.
2. Floated finishes: Depressions between high spots shall not exceed 5/16 inch under a 10-foot straightedge.

F. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified. Repair defects as follows:

1. High areas: Correct by grinding after concrete has cured for not less than 14 days.
2. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete.
3. Crazed or cracked areas: Cut out defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts. Dampen exposed concrete and apply bonding compound. Mix, place, compact, and finish patching concrete to match adjacent concrete.
4. Isolated cracks and holes: Groove top of cracks and cut out holes not over 1 inch in diameter. Dampen cleaned concrete surfaces and apply bonding compound; place dry pack while bonding compound is still active:

    a. Dry-pack mix: One part Portland cement to 2-1/2 parts fine aggregate and enough water as required for handling and placing.
    b. Install patching mixture and consolidate thoroughly, striking off level with and matching surrounding surface. Do not allow patched areas to dry out prematurely.

3.09 CONCRETE CURING AND PROTECTION

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Curing Period:

1. Not less than 7 days for standard cements and mixes.
2. Not less than 4 days for high early strength concrete using Type III cement.

C. Curing Temperature:

1. Concrete shall be maintained above 50^{o} F and in moist condition during the entire curing period.

D. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period.

1. Keep wooden or metal forms moist when exposed to heat of the sun.
2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.

E. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared, but before surface is dry.
2. Keep continuously moist for not less than 3 days by uninterrupted use of any of the following:

    a. Water ponding.
    b. Water-saturated sand.
    c. Water-fog spray.
    d. Saturated burlap: Provide 4-inch minimum overlap at joints.

3. Begin final curing procedures immediately following initial curing and before concrete has dried.

    a. Moisture-retaining cover: Lap not less than 3 inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.

        1) Extend covering past slab edges at least twice the thickness of slab.
        2) Do not use plastic sheeting on surfaces which will be exposed to view when in service.

4. Continue final curing to end of curing period.

F. Avoid rapid drying at end of curing period.

G. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.

3.10 SHORES AND SUPPORTS

A. General: Comply with recommendations of ACI 347 for shoring and reshoring in multistory construction.

B. Low-Rise Construction: Extend shoring from ground to roof for structures 4 stories or less in height.

C. Reshoring: Remove shores and reshore in a planned sequence, to avoid damage to partly cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

D. Provide as a package, shoring and reshoring drawings prepared by or under the direct supervision of a specialty engineer registered in the State the project is located.

3.11 REMOVAL OF FORMS AND SUPPORTS

A. Non-Load-Bearing Formwork: Provided that concrete has hardened sufficiently that it will not be damaged, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours. Maintain curing and protection operations after form removal.

B. Load-Bearing Formwork: Do not remove shoring and forms supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, until concrete has attained at least the specified compressive strength f'(c) and until the contractor has determined that the actual compressive strength attained is adequate to support the weight of the concrete and superimposed loads.

C. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained at least the specified compressive strength f'(c) and until the contractor has determined that the actual compressive strength attained is adequate to support the weight of the concrete and superimposed loads.

D. Keep supports in place until heavy loads due to construction operations have been removed.

E. Test field-cured specimens to determine potential compressive strength of concrete for specific locations.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated on drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment manufacturer.

1. Grout base plates and foundations as indicated with nonshrink grout.
2. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

C. Reinforced Masonry: Provide concrete grout for reinforced masonry where indicated on drawings and as scheduled.

3.13 CONCRETE REPAIRS

A. General: Repairs due to poor workmanship shall be made by the contractor at the contractor's expense and shall be approved by the Engineer prior to repair procedure being implicated.

B. Perform cosmetic repairs of concrete surfaces as specified under concrete application.

C. Perform structural repairs with prior approval of the engineer for method and procedure, using epoxy bonding systems. The engineer's approval is required for repair methods using materials other than those specified.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Testing Agency Services: Employ, at Contractor's expense, an independent testing agency acceptable to the owner and engineer to perform the specified tests and other services required for quality assurance as listed below.

B. Composite Sampling, and Making and Curing of Specimens: ASTM C 172 and ASTM C 31.

1. Take samples at point of discharge.
2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at discharge from line shall be used for acceptance of concrete.

C. Slump: ASTM C 143. One test per strength test and additional tests if concrete consistency changes.

1. Modify sampling to comply with ASTM C 94.

D. Air Content of Normal Weight Concrete: ASTM C 173 or ASTM C 231. One test per strength test performed on air-entrained concrete.

E. Concrete Temperature:

1. Test hourly when air temperature is 40 degrees F or below.
2. Test hourly when air temperature is 90 degrees F or above.
3. Test each time a set of strength test specimens is made.

F. Compressive Strength Tests: ASTM C 39.

1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
2. Testing for acceptance of potential strength of as-delivered concrete:

    a. Obtain samples on a statistically sound, random basis.
    b. Minimum frequency:

        1) One set per 100 cubic yards or fraction thereof for each day's pour of each concrete class.
        2) One set per 3500 square feet of slab or wall area or fraction thereof for each day's pour of each concrete class.

3) When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or from each batch if fewer than 5.
4) One set for the first and last truck for each day of concrete placement.

c. Test one specimen per set at 7 days for information unless an earlier age is required.
d. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the engineer.
e. Retain one specimen from each set for later testing, if required.
f. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:

1) No individual test result falls below specified compressive strength by more than 500 psi.
2) Average of any 3 consecutive strength test results equals or exceeds specified compressive strength f'c.

3. Testing for evaluation of field curing:

a. Frequency: 1 field set of specimens per strength acceptance test.
b. Mold specimens from same sample used for strength acceptance tests. Field-cure, and test at same age as for strength acceptance tests.
c. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.

4. Removal of forms or supports: Mold additional specimens and field-cure with concrete represented; test to determine strength of concrete at proposed time of form or support removal.

G. Test Results: Testing agency shall report test results in writing to engineer and contractor within 24 hours of test.

1. Test reports shall contain the following data:

a. Project name, number, and other identification.
b. Name of concrete testing agency.
c. Date and time of sampling.
d. Concrete type and class.
e. Location of concrete batch in the completed work.
f. All information required by respective ASTM test methods.

2. Nondestructive testing devices such as impact hammer or sonoscope may be used at engineer's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
3. The testing agency shall make additional tests of in-place concrete as directed by the engineer when test results indicate that specified strength and other concrete characteristics have not been attained.

    a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.
    b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.

END OF SECTION

SECTION 04 23 00
REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes:

1. Plain concrete masonry units (CMU).
2. Mortar and grout for plain CMU.
3. Reinforcing steel, anchorage, and accessories for plain CMU.

B. Refer to Division 3, Cast-in-Place Concrete for grout mix designs and testing and Division 4, Unit Masonry Assemblies for decorative CMU, face brick and related items for masonry exposed to view.

1.02 REFERENCES:

Comply with the following documents, except where requirements of the Contract Documents or of governing codes and governing authorities are more stringent. All referenced standards refer to the edition in force at the time these plans and specifications are issued.

A. ACI 530.1/ASCE 6/TMS 602 -- Specifications for Masonry Structures; American Concrete Institute, American Society of Civil Engineers, and The Masonry Society.

B. ACI SP-66 -- ACI Detailing Manual; American Concrete Institute.

C. ASTM A 82 -- Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

D. ASTM A 615 -- Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

E. ASTM A 951 -- Masonry Joint Reinforcement

F. ASTM C 90 -- Standard Specification for Load-Bearing Concrete Masonry Units.

G. ASTM C 129 -- Standard Specification for Non-Load-Bearing Concrete Masonry Units.

H. ASTM C 140 -- Standard Methods of Sampling and Testing Concrete Masonry Units.

I. ASTM C 144 -- Standard Specification for Aggregate for Masonry Mortar.

J. ASTM C 150 -- Standard Specification for Portland Cement.

K. ASTM C 270 -- Standard Specification for Mortar for Unit Masonry.

L. ASTM C 404 -- Standard Specification for Aggregates for Masonry Grout.

M. ASTM C 476 -- Standard Specification for Grout for Masonry.

N. ASTM C 780 -- Standard Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

O. ASTM D 226 -- Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

P. ASTM E 119 -- Standard Methods for Fire Tests of Building Construction and Materials.

Q. NCMA TEK 8-2A -- Removal of Stains from Concrete Masonry.

1.03 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified; submit published data from manufacturers indicating compliance with requirements.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcement: Comply with ACI 530 and 530.1 and ACI SP-66. Include bar schedules, diagrams of bent bars, arrangement of reinforcement splices, and the following:

a. Control Joints.
b. Elevations of reinforcement in all load bearing and shear walls.
c. Openings and details of reinforcement around openings. Coordinate sizes and locations with mechanical, electrical, and architectural drawings.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

a. Include size-variation data, verifying that actual range of sizes falls within specified tolerances.
b. Prism test results.
c. Mortar properties.
d. Grout compressive strength.

E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.

a. Include size-variation data, verifying that actual range of sizes falls within specified tolerances.

2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each material and grade indicated for reinforcing bars.
4. Each type and size of joint reinforcement.
5. Each type and size of anchor, tie, and metal accessory.

F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.05 QUALITY ASSURANCE

A. At contractor's expense, all reinforced masonry wall construction shall be inspected by an engineer licensed in the state the project is located or a certified independent testing agency with a minimum of 5 years experience for such inspections.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Pre-construction Testing Service: Engage a qualified independent testing agency to perform the following pre-construction testing:

1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, using

Prism Test Method per ASTM C 1314.
2. Mortar properties shall be tested per ASTM C 780.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
3. Secure weather protection in place with weights or by use of temporary fasteners.

B. Loading Protection: Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not lay masonry units when outside air temperature is below 40 degrees F. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
2. Grouted Construction: On any day when minimum anticipated nighttime temperature is 32 degrees F or less, in addition to complying with general procedures above, heat grout materials to 90 degrees F to produce in-place grout temperature of not less than 70 degrees F at end of work day. Retain protective blankets or enclose for not less than 48 hours.
    a. Period of protection may be reduced to 24 hours when Type III Portland cement is used for grout.
3. Water: Do not heat water for mortar or grout to more than 160 degrees F.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Weight Classification: light weight
2. Provide Type II, non-moisture-controlled units.
3. Size (Width): Manufactured to the following dimensions:
    a. 4 inches nominal; 3-5/8 inches actual.

b. 8 inches nominal; 7-5/8 inches actual.
c. 12 inches nominal; 11-5/8 inches actual.

4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
   a. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

C. Masonry Cement: ASTM C 91

D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

G. Water: Potable.

2.03 MASONRY REINFORCEMENT

A. Reinforcing Bars: As specified in Division 3.

B. Joint Reinforcement:

1. Load Bearing and Shear Walls: Standard Ladder Type
2. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
3. Wire Size for Side Rods: 9 ga.
4. Wire Size for Cross Rods: 9 ga.
5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units at all corners and intersections.

2.04 NON-LOAD BEARING WALLS: STANDARD TRUSS TYPE

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.

2. Wire Size for Side Rods: 9 ga.
3. Wire Size for Cross Rods: 9 ga.
4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units at all corners and intersections.

2.05 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

C. Galvanized Steel Sheet: ASTM A 653, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.

D. Steel Sheet, Galvanized after Fabrication: ASTM A 366 cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

E. Steel Plates, Shapes, and Bars: ASTM A 36

2.06 BENT WIRE TIES

A. General: Rectangular units with closed ends and not less than 4 inches wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of 1-1/4 inches.

B. Wire: Fabricate from 1/4-inch diameter, hot-dip galvanized steel wire.

2.07 ANCHORS FOR CONNECTING TO CONCRETE

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section: Dovetail anchor section formed from 0.0528-inch- thick, steel sheet, galvanized after fabrication
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch diameter, hot-dip galvanized steel wire.

2.08 RIGID ANCHORS

A. General: Fabricate from steel bars as follows:

1. 1½ inches wide by 1/4 inch thick by 28 inches long, with ends turned up 2 inches.
2. Finish: Hot-dip galvanized to comply with ASTM A 153.

2.09 MISCELLANEOUS MASONRY ACCESSORIES

A. Sealant and Backer Rod: As specified in Division 7.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.

1. Provide units with either two loops or four loops as needed for number of bars indicated.

2.10 MASONRY CLEANERS

A. Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mixing: Use mechanical batch mixer and comply with referenced ASTM Standards.

C. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

1. For masonry below grade, in contact with earth, and where indicated, use Type S.

2. For reinforced masonry and where indicated, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
4. For interior non-load-bearing partitions, use Type N.

E. Grout: ASTM C476; provide consistency required at time of placement to fill completely all spaces indicated to be grouted:

1. Use fine grout in spaces less than 2 inches in least horizontal dimension.
2. Use coarse grout in spaces 2 inches or more in least horizontal dimension.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Verify that foundations are within tolerances specified.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

1. Do not use wet cutting techniques with concrete unit masonry.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Reinforcement and Anchorage: Before placing metal masonry accessories, remove loose rust, dirt, and other coatings.

G. Grout solid all voids and cavities below grade.

3.03 CONSTRUCTION TOLERANCES

A. General: Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼ inch in 10 feet, nor 1/2 inch maximum.

3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thickness by more than 1/8 inch.

6. For plan lines, horizontal construction tolerances for related portions of columns, walls, and partitions shall not exceed 1/2 inch in 32 feet or more.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thickness and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond

pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One – half running bond with vertical joint in each course centered on units in courses above and below.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
2. At fire-rated partitions, install fire stopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.06 BONDING OF MULTIWYTHE MASONRY

A. Use masonry joint reinforcement installed in horizontal mortar joints to bond wythes together.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.07 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 24 inches beyond openings.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in

masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

3.11 LINTELS

A. Install masonry or concrete lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

C. Reinforcement: Refer to plans for reinforcing requirements.

3.12 INSTALLING REINFORCED UNIT MASONRY

A. Preparation: Clean reinforcement bars of loose rust; do not use bars which have rusted excessively or which have bends or kinks not shown on drawings.

B. Placing Reinforcement: Provide vertical spacing as indicated, but not less than 48" on center. Secure reinforcement accurately at locations indicated and to avoid displacement; minimum spacing between bars or to masonry surfaces shall be bar diameter or 1/4 inch for fine grout and 1/2 inch for coarse grout, whichever is greater.

C. Splicing: Provide lapped splices of minimum size indicated or permitted by governing code at locations shown; other methods or locations must be approved by the architect.

D. Formwork: Construct formwork where required for temporary support of reinforced masonry, bracing as required to maintain proper shape during placement and curing of grout and adequately tight to avoid grout leakage.

E. Mortar Joints: Where reinforcement other than prefabricated joint reinforcement is required in mortar joints, adjust joint thickness to provide not less than 1/4 inch of mortar between reinforcement and masonry surfaces.

F. Reinforced Hollow Unit Masonry: Maintain vertical continuity of core or cell cavities to be grouted. Keep cavities clear of mortar, including bed area of first course, to provide minimum clear dimension indicated, to provide minimum clearance and grout coverage for vertical reinforcement bars, and to provide direct grout contact with supporting surfaces.

1. At bond beams or other horizontally reinforced masonry, provide special masonry units or saw units to accommodate reinforcement.
2. Contractor option: Fill all cores with grout in lieu of closing core spaces below bond beams and providing mortar bedding of masonry cross webs.

3.13 GROUTING

A. Contractor's Option: Use either high-lift or low-lift grouting techniques, subject to other limitations of the contract documents.

1. Do not use high-lift grouting in any situation in which fine grout must be used because of dimensional constraints.

B. Low-Lift Grouting of Hollow Unit Masonry- Comply with the requirements of ACI530.1/ASTM 6/TMS 602 and as follows:

1. Maintain minimum dimension of 2 inches and minimum area of 6 square inches in cells to be grouted. Extend vertical reinforcement above pour height as required for splicing.
2. Lay masonry units to maximum pour height, not to exceed 5 feet.
3. Place grout continuously, and consolidate immediately; do not interrupt pour for more than one hour. Terminate each pour 1 to 1-1/2 inches below top course, except at tops of walls.
4. Stop vertical pours 1-1/2 inches below bond beam locations; place reinforcement and pour bond beams to interlock with vertical cores.

C. High-Lift Grouting of Hollow Unit Masonry- Comply with the requirements of ACI530.1/ASTM 6/TMS 602 and as follows:

1. Limit high-lift grouting to cores with minimum dimension of 3 inches and minimum core area of 9 square inches. Provide clean out holes at bottom of each core to be grouted, and as indicated.
2. Construct masonry to full height of maximum grout pour specified, prior to placing grout. Unless otherwise indicated, limit grout placement for hollow concrete masonry unit walls to vertical dimensions as follows:

    a. Maximum grout lift: 4 feet.
    b. Maximum grout pour: 24 feet.

3. Support vertical reinforcing at intervals of not more than 10 feet or 192 bar diameters, whichever is less, and install horizontal reinforcement as masonry is laid.

4. Clean grout spaces before grouting masonry, eliminating dirt, dust, loose pieces of masonry, mortar droppings, and other foreign materials. Clean reinforcement and adjust to proper position. After final cleaning and inspection, close cleanout holes with matching masonry units, and brace closures to resist grout pressures.
5. Do not pour grout until mortar has cured sufficiently to withstand grout pressure.
6. Pump grout into prepared cavities, unless architect has approved alternative methods; consolidate each lift immediately, but avoid damage to previous grout pours. Do not allow more than one hour between lifts of a single pour.
    a. Place grout for spanning elements in a single, continuous pour.
    b. Bond beams which fall below top of a pour may be filled with grout as masonry is constructed, stopping at least one inch short of vertical cores to be grouted so vertical pours will interlock with bond beam.
7. Extend reinforcement beyond pour dimensions for splicing when additional pours are required; in such situations, stop pour 1 to 1-1/2 inches below top course.

3.14 QUALITY ASSURANCE & INSPECTION PROGRAM

A. Testing Agency Services: Employ, at contractor's expense, an independent testing agency acceptable to the owner and architect to perform specified tests and other services required for quality assurance as listed below.

B. Prism Test: Provide according to ASTM standards during construction for each 5000 ft^2 of wall area or portion thereof. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days. Verify f'm called for in the contract documents prior to construction.

C. Mortar properties will be tested in accordance with ASTM C270 & field evaluated in accordance with ASTM C780. Provide two samples consisting of three specimens for each 2500 ft^2 of wall area. Also samples shall be taken when there is any change in the mix proportions, materials used, or in the mixing method. Field tested specimens shall meet or exceed a 28 day compressive strength of 1500 psi in accordance with ASTM C1019. Verify proportions of materials in mortar as delivered to the site.

D. Grout will be sampled and tested for compressive strength for each 5000 ft^2 of masonry wall surface. Verify proportions of materials in grout as delivered to the site. Field mix grout shall be tested for each day's mixing operation.

E. Minimum Inspection: From the beginning of masonry construction, the following shall be verified to ensure compliance. Maintain accurate records on site with sufficient detail to prove that the masonry has been inspected prior to and during construction in accordance with the contract documents. Provide final written certification signed and sealed by a registered engineer in the state the project is

located.

Continuous inspections means inspector on site 100% of time during the task being performed.

Inspection Task	Frequency of Inspection	
	Continuous during task listed	Periodically during task listed.
1. Compliance with the approved submittals		**X**
2. Proportions of site-prepared mortar and grout		**X**
3. Placement of masonry units and construction of mortar joints.		**X**
4. Size and location of reinforcement including hooks and lap splices.		**X**
5. Size and location of connectors, anchors, and embeds		**X**
6. Grout space prior to grouting.		**X**
7. Placement of grout and slump.		**X**
8. Size and location of structural elements.		**X**
9. Specified grade and type of reinforcement.		**X**
10. Protection of masonry during cold weather (temperature below 40ºF) or hot weather (temperature above 90ºF).		**X**
11, Welding of reinforcing.		
12. Preparation of any required grout specimens, mortar specimens and/or prisms		**X**
13. Locations and requirements of duct, pipe, and conduit penetrations.		**X**
14. Control joint and/or expansion joint locations and requirements.		**X**
15. Construction Tolerances		**X**

3.15 TEMPORARY BRACING

A. The Contractor shall be responsible for providing temporary bracing for all CMU walls as required during construction.

B. Walls that fail structurally or by overturning due to inadequate bracing shall be replaced at Contractor's expense. Other damage resulting from such failure shall be repaired or replaced at Contractor's expense.

C. Cracks in CMU walls resulting from inadequate bracing shall be repaired at Contractor's expense.

D. Masonry walls exposed to high winds during construction shall not be built higher than ten (10) times their thickness unless adequately braced or until provisions are made for prompt installation of the permanent bracing at the floor or roof areas.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent stone and non masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
4. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 00 00
METALS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor is to furnish all labor, equipment, and materials required to comply with the intent of the Contract Documents pertaining to metals. All tests, samples shop drawings and certifications are to be provided in a timely manner in order not to delay the review process or the construction schedule.

1.02 RELATED WORK

A. Section 05 05 00 Metal Fastenings

B. Section 05 50 00 Metal Fabrications

C. Section 05 52 00 Metal Railings

1.03 REFERENCES

A. All work performed and materials installed by the Contractor are to be in strict accordance with the requirements of the following Codes and Standards:

1. American Society for Testing and Materials:

   a. ASTM A36-08 - "Specification for Carbon Structural Steel"
   b. ASTM A48-03 (2008) - "Specification for Gray Iron Castings"
   c. ASTM A53-07 - "Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
   d. ASTM A123-08 - "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
   e. ASTM A143-03 - "Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement"
   f. ASTM A167-99(2004) - "Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip"
   g. ASTM A193-08b - "Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications"
   h. ASTM A194-08b - "Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both"
   i. ASTM A276-08a - "Specification for Stainless Steel Bars and Shapes"
   j. ASTM A307-07b - "Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength"

k. ASTM A325-09 - “Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength”
l. ASTM A500-07 - “Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes”
m. ASTM A536-84(2004) - “Specification for Ductile Iron Castings”
n. ASTM A563-07a - “Specification for Carbon and Alloy Steel Nuts”
o. ASTM A653-08 - “Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated Galvannealed) by the Hot-Dip Process”
p. ASTM A992-06a - “Specification for Structural Steel Shapes”
q. ASTM B69-08 - “Specification for Rolled Zinc”
r. ASTM B221-08 - “Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes”
s. ASTM F436-09 - “Specification for Hardened Steel Washers”
t. ASTM F959-07a - “Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners”
u. ASTM F1554-04e1 – “Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

2. Occupational Safety and Health Administration

3. American Institute of Steel Construction – Steel Construction Manual

4. American Society of Civil Engineers - Proceeding Paper 970, Aluminum Alloys.

5. Aluminum Association - Aluminum Design Manual – ADM1-05.

6. American Welding Society – AWS D1.1 - Structural Welding Code

7. All applicable local, State and Federal Building Codes.

8. National Association of Architectural Metal Manufacturers - “Metal Bar Grating Manual”

9. International Building Code, Pennsylvania Edition, 2018

B. In the case of conflicting requirements in any of the above listed Codes and Standards, the most stringent is to govern.

1.04 STANDARD REQUIREMENTS

A. In general, for the fabrication of all metal work items which will be exposed to view, the Contractor is to use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. He is to remove such blemishes by grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

1.05 SUBMITTALS

A. Shop drawings shall be submitted in accordance with the specific requirements of each Division of the Specification.

B. Shop drawings shall show complete details and schedules for the fabrication and shop assembly of members; and details, schedules, procedures and diagrams showing the sequence of erection. The Engineer's review of shop drawings shall be for general considerations only. Compliance with requirements for materials, fabrication, and erection of structural steel shall be the Contractor's responsibility.

C. Included in the shop drawings submission shall be details of cuts, connections, camber, holes, or other pertinent data. The Contractor shall indicate welds by standard AWS symbols; and show size, length, and type of each weld. He shall also provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.

D. All shop drawings, tests, samples or other required preliminary information are to be submitted for the review and approval of the Engineer prior to the fabrication and/or delivery of materials to the Project Site.

PART 2 – PRODUCTS

2.01 ALUMINUM

A. Unless otherwise noted, aluminum is to be 6061-T6 alloy fabricated in accordance with the American Society of Civil Engineers (Proceeding Paper 970). Aluminum is to have a mill finish, unless otherwise specified.

B. Where aluminum comes in contact with other metals, the Contractor is to provide a dielectric material over the entire contact surfaces.

2.02 IRON

A. Cast iron castings are to be of tough, close grained gray iron, free from blowholes, shrinkage and cold shuts. They are to be sound, smooth, cleaned and free from blisters and defects. Materials for iron castings are to conform in all respects to ASTM A48 for Class 30B castings, except as otherwise designated.

B. Ductile iron castings are to be of nodular iron, free from blowholes, shrinkage and cold shuts. They are to be sound, smooth, clean and free from blisters and defects. All material for ductile iron castings are to conform to ASTM A536 for Grade 65-45-12, except as otherwise designated.

C. Wrought metals and castings are to be sandblasted or ground smooth.

2.03 STEEL

A. Structural Steel hot-rolled W-shapes shall conform to ASTM A992. Structural Steel hot-rolled S-shapes, C-shapes, MC-shapes, angles and plates shall conform to ASTM A36. Materials are to be free from loose mill scale, rust pits, or other defects affecting their strength and durability.

B. Structural steel products are to be safeguarded against embrittlement in accordance with ASTM A143. Malleable iron is to be safeguarded against impertinent by pre-annealing.

C. All base metal is to be thoroughly cleaned using appropriate solvents and wire brushes prior to pickling.

D. Zinc for galvanizing is to be of any grade conforming to ASTM B6. All galvanizing is to be done by the hot-dip process in conformity with all requirements of ASTM A123 and American Hot Dip Galvanizers Association, Inc. The coating shall have an average weight of 2.0 ounces per square foot.

E. Stainless steel is to conform to ASTM A167 and ASTM A276. Bolting materials are to conform to ASTM A193.

F. Unless otherwise shown on the Contract Drawings, all stainless steel not submerged is to be Type 304. All stainless steel that is to be submerged or partially submerged shall be 316L.

G. Bolts and nuts are to conform to the U.S. Standards and are to be clean cut and have well-fitted threads.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. To the greatest extent possible, embedded items are to be set and secured before the concrete has been placed, except where expansion bolt usage is permitted.

B. Welds are to be electric welds and are to be in accordance with best recognized practices.

C. All shapes and assemblies are to be of accurate dimension and free from any defects.

D. Work is to be accurately fabricated according to approved details with straight, true edges, sharp angles and smooth surfaces, free of pits and scratches. Curves are to be smooth and even.

E. Work is to be amply strong and rigid with sound, strong, secure joints. Exposed joints are to be precise and close fitting.

F. Fastenings are to be concealed where possible. Exposed welds are to be ground smooth. Exposed rivets, bolts and screws are to be countersunk. Provide lock washers or lock nuts for all bolts. Use galvanized fastenings and accessories for galvanized metal.

G. The Contractor is to do all drilling, tapping, cutting and fitting of miscellaneous metal necessary for installation of or attachment of engaging work.

H. Castings with weight variations exceeding 5% less than that which might be expected due to the casting dimensions will not be accepted. The Contractor is to furnish all equipment which would be necessary for weighing castings in the presence of the Engineer upon request.

I. Metal items set in concrete are to be placed and securely anchored to the concrete forms prior to placing of concrete. Where metal items are to be placed in the concrete at a later date, openings are to be provided of adequate size and shape to accommodate those items to be placed. Metal items to be attached to concrete and/or masonry are to have inserts, sleeves, or other devices provided and placed in the work as it progresses.

J. Castings, metal shapes and assemblies are to be set in place true, level and plumb and shall be securely anchored to the materials in which they are inserted.

K. All aluminum in contact with concrete or masonry is to receive a heavy coating of bituminous paint, dielectric material or gasketed with care taken to protect the aluminum finish on exposed sections. All aluminum surfaces are to be fully protected during and after erection.

L. Painting of all materials being furnished under this Division of the Specifications is specified in Division 07 of these Specifications. Bronze, galvanized steel, stainless steel, and aluminum are not to be painted, unless otherwise shown on the Contract Drawings or indicated in the Specifications. Factory finished aluminum work is specified under the respective items.

3.02 TESTING

A. All elements supplied and/or erected may be subject to inspection and laboratory or field tests for strength, durability, appearance or other considerations. Tests are to be performed in accordance with the specific requirements of each Division of the Specifications.

B. The cost of testing shall be included in the cost of the various items. Failed elements shall be subject to retesting or more extensive testing to the satisfaction of the Engineer. The cost of retesting elements that fail initial testing shall be borne by the contractor.

C. Such inspections and tests are not to relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

D. The Contractor shall notify the Engineer in writing one week in advance of the starting of fabrication and/or erection of the steel members in order that the necessary inspection of the work may be made.

E. The Engineer shall have free access, and the Contractor shall provide same, to all points where materials for this Project are being fabricated or erected and all materials, equipment and workmanship shall be subject to inspection, tests and approval by the Engineer.

F. The Engineer reserves the right to reject any or all units delivered or included in the construction which do not meet the specified requirements itemized or construed to be included in the preceding paragraphs. Cost incurred due to rejected materials or improper construction are to be borne by the Contractor.

3.03 COORDINATION OF WORK

A. The contractor is to take field measurements where possible in preparation of shop drawings for fabrication. Dimensions shown on the contract drawings are permitted to be adjusted to account for actual field conditions. Revised dimensions are to be reflected on the shop drawings. The commencement for work will be interpreted as acceptance and understanding of field conditions unless previously submitted in writing. Any inaccuracies shall be reported to the Engineer in writing.

B. The Contractor is to be satisfied as to the compatibility of those elements being delivered with the actual physical constraints of the construction by measurements or other means prior to installation. No element is to be modified without the modification being reviewed by the Engineer or the authorized representative.

C. The Contractor is to be held responsible for the accurate location of all his metal work. He is to engage the necessary services required to lay out the work accurately in the field and establish all grades, levels and locations for his work. He is to see that all items of his work which are to be built into other construction are installed at the proper time and that these items are correctly located and maintained in such a location during the course of the construction.

D. Any misfit due to errors in locations and inaccuracies in the setting of items or attachment of metal work is to be removed and made good in a manner as the Engineer will direct and at no cost to the City.

3.04 FABRICATION

A. The Contractor is to preassemble items in the shop to the greatest extent possible to minimize field splicing and assembly. He is to disassemble units only as necessary for shipping and handling limitations. He is to clearly mark all units for reassembly and coordinated installation.

B. The Contractor is to use materials of the size and thicknesses shown. He is to work to dimensions shown or as accepted on the shop drawings, using proven details of fabrication and support. The Contractor is to use the type of materials shown or specified for the various components of the work.

C. The Contractor is to form all exposed work true to line and level with accurate angles and surfaces and straight sharp edges. He is to ease exposed edges of metal materials to a radius of approximately 1/32", unless otherwise shown. He is to form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

D. The Contractor is to weld corners and seams continuously, complying with AWS recommendations. At exposed connections, the Contractor is to grind exposed welds smooth and flush to match and blend with adjoining surfaces. The Contractor shall not weld, cut or abrade the surface of exterior units which have hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. The Contractor is to form exposed connections with hairline joints, flush and smooth, using concealed fasteners, wherever possible. He is to use exposed fasteners of the type shown, or if not shown, Phillips flat-head countersunk screws or bolts.

F. The Contractor is to provide for anchorage of the types shown, coordinated with the supporting structure. He is to fabricate and space anchoring devices to provide adequate support for their intended use.

G. The Contractor is to cut, reinforce, drill and tap all metal work as indicated to receive finish hardware and similar items.

3.05 STORAGE AND PROTECTION OF MATERIALS

A. All materials are to be effectively protected from injury which would harm their structural or appearance qualities. Such protection is to be provided during fabrication, delivery, erection and until the work is finally accepted.

B. Materials are to be stored in such a manner that they are completely protected from dirt, water and other materials.

C. All metal work received at the Project Site is to be placed upon substantial shores or blocking furnished by the Contractor. Shores or blocking are to be of sufficient size and strength to prevent any metal work from touching the ground, and to facilitate the later removal of the material. Each piece is to be placed so that water cannot stand thereon, and so that bending under its own or superimposed weights or from any other causes will not damage the piece. The acceptance of material improperly stored is to be entirely at the discretion of the Engineer.

D. The Contractor is to use care in handling and erecting all materials and is to support materials properly at all times to insure that they will not be bent, twisted or otherwise damaged. The Contractor is to notify the Engineer, in writing, before installation, of any defects or damages that cannot be corrected in the field and the material is to be returned to the shop, or new parts furnished, as the Engineer directs. The Contractor is to pay all expenses if such defects or damages are due to his negligence.

3.06 SPECIAL REQUIREMENTS

A. All special requirements, which pertain to specific areas of metals constructions, are to be as specified in the particular Section of the Specification relating to that work.

B. Details for construction of metal work may be indicated on the Contract Drawings. In the absence of specific details, the Contractor is to employ the best industry-standard practice and conform to all applicable local, State and Federal Building Codes as minimum acceptable standards.

C. Metal items which are to be embedded in concrete or masonry and which are to be placed in the formwork before the concrete is placed or masonry set are to be furnished and delivered for setting and installation by the Contractor.

D. The Contractor is to provide the necessary holes in all steel for the attachment of work by others. He is to obtain all necessary information regarding any holes and detail the steel accordingly.

3.07 INSTALLATION

A. The Contractor is to provide anchorage devices and fasteners where necessary for securing all metal fabrication to in-place construction including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connections as required.

B. All cutting, drilling and fitting for the installation of all metal fabrication is to be performed by the Contractor. All work is to be set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. He is to provide temporary bracing or anchors in formwork for items which will be built into concrete, masonry or similar construction.

C. The Contractor is to fit exposed connections accurately together to form tight hairline joints. He is to weld connections which will not be left as exposed joints, but cannot be shop welded because of shipping size limitations. All exposed joints are to be ground smooth and shop paint coats are to be touched-up. The Contractor is not to weld, cut or abrade the surfaces of exterior units which have been hot-dipped galvanized after fabrication, and are intended for bolted or screwed field connections.

D. The Contractor is to comply with the AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and the methods used in correcting welding work.

E. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint or galvanizing on all metal work are to be as specified in accordance with the requirements of the project Specifications.

3.08 SHOP PRIMING

A. Shop priming of metal work is to be compatible with the finished painting system, where applicable, as specified in accordance with the requirements of the project Specifications. The shop priming is to be included as a part of the delivered metal.

3.09 CLEANING UP

A. The Contractor is to remove any rubbish that may accumulate from time to time as the Engineer will order and upon completion of the work, is to remove all rubbish occasioned as a result of the operation and leave the premises in a condition acceptable to the Engineer.

END OF SECTION

SECTION 05 05 00
METAL FASTENINGS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Under this Section of the Specifications, the Contractor is to furnish and install all metal fastenings as shown on the Contract Drawings and/or as specified herein.

B. All fasteners are to be of the best industry standard quality. They are to be chosen for suitability according to strength and durability, and appearance where exposed. Fasteners are to be of the same quality as, or better than, the materials which they fasten. Particular fasteners are described in more detail in other sections and Divisions of these Specifications. Fasteners shown on the Contract Drawings are to be furnished and supplied as detailed.

PART 2 – PRODUCTS

2.01 METAL FASTENERS

A. All fasteners exposed to weather, or used in aluminum work, are to be stainless steel. Fasteners used for interior steel work are to be steel. Accessories, such as washers, are to be the same material and quality as the fasteners and are to be appropriately sized. All bolts are to be of sufficient length that at least two threads are exposed after the nuts are tightened.

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. All joints between dissimilar materials which react electrolytically are to be separated with appropriate insulators, such as micarta strips, or protected with zinc chromate primer, as directed.

B. All metal fastenings are to be installed in conformance with the Manufacturer's recommendations and with the best practices in the construction industry.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Metal fabrications include but are not limited to items such as ladders, cages, castings, fasteners and supports, stair and sill nosings, gratings and frames, floor hatches, grab pipes, guard posts, plates and frames, manhole steps, trash baskets and other such items which may require special fabrication to satisfy design intent.

1.02 QUALITY ASSURANCE

A. All work performed and materials installed by the Contractor are to be in strict accordance with the latest requirements of the following governing Codes and Standards:

1. Aluminum Association - Aluminum Construction Manual
2. American Society of Civil Engineers - Proceeding Paper 970
3. American Society for Testing and Materials – See Metals Section 05 00 00
4. American Welding Society - “Structural Welding Code”
5. National Association of Architectural Metal Manufacturers - “Metal Bar Grating Manual”
6. Occupational Safety and Health Administration
7. International Building Code, 2018

B. In the case of conflicting requirements in any of the above listed Codes and Standards, the most stringent is to govern.

1.03 STANDARD REQUIREMENTS

A. Aluminum in contact with concrete, masonry or dissimilar metals is to be protected by paint such as zinc chromate or a bituminous coating, or by isolating micarta strips where appropriate.

B. Aluminum work is to be mill finished.

C. All joints between dissimilar materials, which react electrolytically, are to be separated with appropriate insulators, such as micarta strips, or protected with zinc chromate primer, as directed.

1.04 SUBMITTALS

A. Shop drawings, tests, certifications and product literature are to be submitted for record and approval purposes. No fabrication, delivery or installation is to begin without the Engineer's review completed.

PART 2 - PRODUCTS

2.01 LADDERS

A. All aluminum construction; mill finish; side rails to be 2½" x ½", 6061-T6 alloy; rungs to be 1" square, solid aluminum, 6061-T6 alloy bar of non-skid design; rungs shall be covered with "SlipNOT Ladder Rung Cover" as manufactured by SlipNOT; rungs shall be Grade 3, course texture, with a anti-slip surface consisting of aluminum oxide particles 8 to 10 matrix, and a coefficient of friction less than 0.6; rungs covers shall be bonded to rung a minimum of 2,000psi as per ASTM C633; rungs to be welded to side rails; rungs to be spaced at 12" on center with a minimum 18" clear width between side rails; wall anchors to be 6061-T6 alloy of bent 6" x 4" x 2" size; wall anchors to be spaced at six (6') foot maximum centers; all connections to be neatly welded with all welds ground smooth and polished. All aluminum shall be free from blemishes or defects of any type that can affect durability, strength or appearance.

2.02 LADDER SAFETY POST

A. Shall be "LadderUP" model "LU-4," as manufactured by The Bilco Company, or equal. Post shall be high-strength aluminum 6061-T6 square tubing, with a mill finish. Post shall be retractable, and shall automatically lock when fully extended. Post shall extend at least 42" above top of hatch in raised position, and shall bear a pull-up loop at the top end. Provide a stainless steel spring balancing mechanism to allow for a smooth, controlled operation when raising and lowering the safety post. Spring nuts shall be galvanized steel; all other mounting hardware shall be Type 316 stainless steel. Product shall come pre-assembled from the manufacturer.

2.03 GRAB BARS

A. Aluminum piping, 1½" diameter nominal pipe, 6061-T6, Schedule 40; pipes to be terminated at the top end with a rounded solid closure piece; pipes to be installed as shown on Contract Drawings. Pipes to be reinforced with 1½" O.D. solid round bars 1'-0" long of 6061-T6 aluminum as indicated on the Contract Drawings.

2.04 PLATES AND FRAMES

A. All aluminum construction 6061-T6 material; frames to be 3" minimum thickness with "Z" anchors at two foot (2') maximum centers; plates to be checkered diamond point pattern or raised profile and of sufficient thickness to withstand 300 pounds per $ft.^2$ live load or mid-point 600 pound concentrated load with a deflection limited to L/240; provide stainless steel counter sunk screw fasteners at two foot (2') maximum centers; smooth all edges; checkered plates to be as manufactured by Alcoa, or equal.

2.05 FOUNDATION BOLTS

A. All anchor bolts shall be set to the dimensions given on the shop drawings and shall be positioned by use of a template. In case of heavy equipment, it is recommended that anchor bolts be set in pipe sleeves and grouted upon completion of equipment installation. Such pipe sleeves are to be used to provide flexibility in the installation. Embedment depths are to be maintained from bottom of pipe sleeve. All anchor bolts are to be provided with adjusting nuts and washers for leveling the equipment. Stainless steel anchor bolts are to be installed for all equipment, consisting of stainless steel threaded top bolts, washers and shims, pinned to a carbon steel lower bolt by means of a carbon steel union.

2.06 ALUMINUM CHAIN

A. All aluminum construction, 6061-T6 alloy fabricated in accordance with the American Society of Civil Engineers (Proceeding Paper 970); Aluminum is to have a mill finish, unless otherwise specified; Chain shall be 3/8" with 3/8" x 4" safety spring hooks at each end; provide aluminum eye bolts with handrail for attachment of safety chain.

2.07 FASTENERS AND SUPPORTS

A. Fasteners of stainless steel nuts, bolts and washers; sufficient in size and number to transmit all loads normally anticipated. Supports are to be threaded rod, end-thread rod or rolled structural elements of aluminum; all suitably sized and located to carry or support intended loads.

2.08 SPECIAL FABRICATIONS

A. Steel, aluminum or stainless steel shall be detailed in accordance with best industry practice and suitable for the use intended.

2.09 STAIR NOSINGS

A. Embedded anchor type.

   a. Stair nosings: Balco Inc. "DXH-330," or equal; two (2) component, non-slip type ⅜" thick by 3" deep, length to be full width of stair tread minus three (3") inches on either side.

2.10 ALUMINUM GRATINGS AND FRAMES

A. All aluminum construction; bearing bars and cross bars of gratings and frames to be of 6061-T6 material; frames to be 2" minimum thickness with "Z" anchors at maximum two (2) foot centers; gratings to have minimum 1-1/2"x3/16" bearing bars with depth to withstand 300 pounds per ft^2 live load or mid-point 600 pound concentrated load with a deflection limited to L/240, unless otherwise indicated; provide hold-down clips minimum two per panel or maximum at 24" centers on all gratings, except where such gratings are required to be removable; to be provided with all openings required for piping and equipment; all edges and

openings to be banded and reinforced; grating to be Borden Metal Products, Type "S/B", or equal.

2.11 FLOOR HATCHES

A. Floor hatches shall be single leaf Type J or double leaf Type JD, as manufactured by Bilco Company, or equal. Floor hatch shall provide compression spring operators enclosed in telescopic tubes for smooth, easy and controlled door operation throughout the entire arc of opening and closing; operation shall not be affected by temperature. Hatch shall be engineered with compression spring operators enclosed in telescopic tubes and automatic hold-open arm with grip handle release for smooth, easy one-hand door operations. Hatch shall be corrosion resistant.

B. Hatch cover and frame material shall be ¼" thick minimum. Cover shall be a diamond pattern plate and reinforced to withstand a live load called for on Contract Drawings, or a minimum of 300 pounds per ft^2 with a maximum deflection of $1/150^{th}$ of the span. Frame shall be fabricated with bend down anchor tabs around the perimeter; a 1-½" drain coupling shall be located in the front right corner of the frame. Gasket shall be EPDM gasket mechanically attached to the frame. Hinges shall be with Type 316 stainless steel hinge pins. Latch, for both single leaf and double leaf, shall be Type 316 stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle; latch release is to be protected by a flush, gasketed, removable screw plug. Hardware shall be zinc-plated and chromate-sealed and all fasteners shall be Type 316 stainless steel. Installation shall be in accordance with Manufacturer's instructions; Manufacturer shall guarantee against defects in material or workmanship for a period of five years. The Contractor shall submit designs for special units where indicated on the Contract Drawings.

C. Materials shall be as shown on the drawings.

2.12 STAINLESS STEEL HATCH

A. All stainless steel construction; hatches shall be "Type J" single leaf, Type 304 stainless steel, as manufactured by Bilco Company, or equal. Hatch shall be reinforced to withstand a live load called for on Contract Drawings, or a minimum of 100 pounds per square foot.

2.14 WATERTIGHT HATCHES

A. Prefabricated: all aluminum construction watertight to a minimum water depth of five feet; to be provided with all required accessories for proper connection through the slab as needed. Hatches to be manufactured by Freeman Marine Equipment, Inc. or equal. A galvanized steel security bar, ad detailed in Contract Drawings, with stainless steel pad lock shall be provided for hatches. Safety accessories required for the square hatch shall include a mechanical assist device to allow one person to open and to prevent slamming shut. Also, a hold-open device shall be provided to prevent accidental closing.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. All work is to be performed in strict conformance with OSHA, NAAMM, ASCE, AA, AWS, ASTM, Local Building Codes, Safety Codes and the Contract Documents.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Urethane joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

1.03 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

B. Field-Adhesion-Test Reports: For each sealant application tested.

C. Qualification Data: For qualified Installer.

D. Sample Warranties.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint- sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Verify sealants and sealant primers comply with the following:

1. Architectural sealants have a VC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for porous substrates have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.03 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

2.04 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.05 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Alcot Plastics Ltd.
b. BASF Corporation.
c. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work and joint sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint- sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form

smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so

sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Control and expansion joints in unit masonry.

b. Joints between different exterior materials.
c. Perimeter joints between materials listed above and frames of exterior doors, windows, and louvers.
d. Exterior door thresholds.
e. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Vertical joints on exposed surfaces of walls and partitions.
c. Perimeter joints between interior wall surfaces and ceilings.
d. Perimeter joints between interior walls and frames of doors and windows.
e. Penetrations through interior non-fire rated partitions.

f. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex, OP, NF.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Exterior standard hollow metal doors and frames.

B. Related Sections:

1. Division 08 Section 08 71 00 "Door Hardware" for door hardware for hollow metal doors.
2. Division 09 Section 09 90 00 "Painting and Coating" for field painting hollow metal doors and frames.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.

2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Fleming Door Products Ltd.; an Assa Abloy Group company.
4. Karpen Steel Custom Doors & Frames.
5. Kewanee Corporation (The).
6. Steelcraft; an Ingersoll-Rand company.
7. Or Approved Equal

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft.

density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.03 EXTERIOR STANDARD HOLLOW METAL DOORS

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm).
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.042-inch (1.0 mm), with minimum A60 (ZF180) coating.
   d. Edge Construction: Model 2, Seamless.
   e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
   f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
   g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
   h. Core: Manufacturer's standard Polystyrene, Polyurethane, or Polyisocyanurate.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053-inch (1.3 mm), with minimum A60 (ZF180) coating.
   b. Construction: Full profile welded.

2.04 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.05 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

2.06 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
3. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Door hardware schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product

B. Keying schedule. Prepared by or under the supervision of Installer, detailing City's final keying instructions for locks.

1.03 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and City about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC)

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.

2.02 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.If door hardware is scheduled in another Division 08 Section, insert its location in subparagraph below.

1. Door hardware is scheduled in Part 3.

2.03 HINGES

A. Hinges: BHMA A156.1: Pin and Barrel Type Continuous Stainless Steel Hinges. Heavy duty 14-gauge, 304 stainless steel.

B. Finish: US32D Satin Stainless Steel Finish

C. Fasteners: Tamper-proof security screws

D. Manufacturers: Marker Architectural Products by Pemko Manufacturing Co.

2.04 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Levers: Cast.
2. Escutcheons (Roses): Cast.
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

F. Bored Locks: BHMA A156.2; Grade 1 Series 4000.

1. Allegion – 229 Cherry Hill Road, Parsippany, NJ 07054 - 973-299-3100
2. Best – 6161East 75th St. Indianapolis, IN 46250- (317) 849-2250

3. Corbin Russwin-PO Box 25288 Charlotte, NC 28229-8010 (704) 283-2101
4. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
5. Sargent - 100 Sargent Drive PO Box 9725 New Haven CT 06536 (800)-727-5477
6. Stanley – 480 Myrtle Street New Britain CT 0053 (800) 622-4393

2.05 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3

1. Allegion – 229 Cherry Hill Road, Parsippany, NJ 07054 - 973-299-3100
2. Corbin Russwin-PO Box 25288 Charlotte, NC 28229-8010 (704) 283-2101
3. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
4. Sargent - 100 Sargent Drive PO Box 9725 New Haven CT 06536 (800)-727-5477
5. Stanley – 480 Myrtle Street New Britain CT 0053 (800) 622-4393

2.06 LOCK CYLINDERS

A. High-Security Lock Cylinders: BHMA A156.30; **Grade 1** permanent cores that are removable; face finished to match lockset.

1. Type: Manufacturer: ASSA High Security Locks

B. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.07 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock.

1. Master Key System: Change keys and a master key operate cylinders.

a. Provide three cylinder change keys and five master keys.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: **"DO NOT DUPLICATE."**

2.08 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

1. Allegion – 229 Cherry Hill Road, Parsippany, NJ 07054 - 973-299-3100
2. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
3. Rockwood Manufacturing – PO Box 79 Rockwood PA 15557 (814) 926-2026
4. Trimco – Los Angeles CA. (323)- 262-4191

2.09 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Allegion – 229 Cherry Hill Road, Parsippany, NJ 07054 - 973-299-3100
2. Corbin Russwin-PO Box 25288 Charlotte, NC 28229-8010 (704) 283-2101
3. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
4. Rixson Specialty Door Controls – Monroe NC – 1-800 457 5670
5. Sargent - 100 Sargent Drive PO Box 9725 New Haven CT 06536 (800)-727-5477
6. Stanley – 480 Myrtle Street New Britain CT 0053 (800) 622-4393

2.10 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
2. National Guard Products – 4985 E. Raines Rd. PO Box 753430 Memphis TN. 38118
3. Pemko Manf. Co. – 4226 Transport Street Ventura CA 93003 – 1800 283 9988
4. Zero International Inc. – 415 Concord Avenue Bronx NY 10455 – 1800-635-5335

B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.

2.11 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
2. National Guard Products – 4985 E. Raines Rd. PO Box 753430 Memphis TN. 38118
3. Pemko Manf. Co. – 4226 Transport Street Ventura CA 93003 – 1800 283 9988
4. Rixson Specialty Door Controls – Monroe NC – 1-800 457 5670
5. Zero International Inc. – 415 Concord Avenue Bronx NY 10455 – 1800-635-5335

2.12 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Allegion – 229 Cherry Hill Road, Parsippany, NJ 07054 - 973-299-3100
2. Hager – 139 Victor St. St. Louis MO. 63104 – 1-800-325-9995
3. Rockwood Manufacturing – PO Box 79 Rockwood PA 15557 (814) 926-2026
4. Trimco – Los Angeles CA. (323)- 262-4191

2.13 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless

other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by City.
2. Furnish permanent cores to City for installation.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.02 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.03 DOOR HARDWARE SCHEDULE

Door Hardware Set No. **HW-1**

No.	**Item**	**Description**
1	Continuous SS Hinges	Marker 300
1Ea.	Rim Exit Device Push pad- fire exit HDWR @ Active Door	Type 1 x Mortise Function
1 Ea	Cylinder	ASSA- Twin 6000- 6552-5
2 Ea	Closer	C03011
1 Ea	Drip Guard	Continuous
2 Ea	Door gasketing kit	
2 Ea	Stainless Steel Kick Plate	J102

1 Ea	Coordinator	
1 Set	Throwbolts	

END OF SECTION

SECTION 08 91 19
FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Sightproof, Drainable-Blade Louver:

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

a. Greenheck Fan Corporation.
b. Ruskin Company.
c. Or approved equal.

2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

a. Free Area: Not less than 7.0 sq. ft. for 18-inch- wide by 16-inch- high louver.
b. Point of Beginning Water Penetration: Not less than 900 fpm.
c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area exhaust or intake velocity.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screens at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening and insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
2. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch thick.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

G. Provide extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following substrates.

1. Concrete
2. Concrete Masonry Units (CMU)
3. Steel
4. Ductile Iron
5. Galvanized Metal

B. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Work Not Included: Coating of surfaces below Pump Station finish floor subject to immersion and fume service

1.02 DEFINITIONS

A. Agencies, and the abbreviations used to reference them, include the following:

1. ASTM American Standards for Testing Materials.
2. FMFactory Mutual.
3. MDF Mils Dry Film
4. NAPF National Association of Pipe Fabricators, Inc.
5. PCB Polychlorinated Biphenyl
6. SSPC Steel Structures Painting Council
7. TCLP Toxicity Characteristic Leaching Procedure

B. Finishes:

1. Flat: A lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell: Low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.
3. Semi Gloss: Medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
4. Gloss: High-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

1.03 SUBMITTALS

A. Product Data: For each type of paint product indicated.

B. MSDS Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats. Products shall not contain asbestos, TCLP metals and PCB's.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information.

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F. Maintain storage containers in a clean condition, free of foreign materials and residue. CITY requires additional safety controls and health rules for on-site service for flammable material storage:

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

PART 2 - PRODUCTS

2.01 PAINT, GENERAL

A. Material Compatibility

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Paints and Coatings: Provide products that comply with Federal and the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Maryland Regulations on VOC content limits for Architectural and Industrial maintenance coatings (COMAR 26.11.39.05).

    a. Industrial/Maintenance Coating: 250 g/l., 2.08 lb./gal.
    b. Floor Coatings: 100 g/l., 0.83 lb./gal.
    c. High Temperature Coatings: 420 g/l., 3.50 lb./gal.
    d. Metallic Coatings: 500 g/l., 4.15 lb./gal.
    e. Primer, sealers & undercoaters: 100 g/l., 0.84 lb./gal.

C. Chemical Components of Field-Applied Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Use Materials (RUM): Paints and coatings shall not contain any materials prohibited by the CITY Special Conditions and Safety Guidelines.

D. Flame Spread: In accordance with ASTM E84, Class A with flame spread 0-25; smoke- developed 0-450.

E. Non-Skid Surfaces: For surfaces designated in paint schedule to be "non-skid", broadcast 36-40 mesh dry silica aggregate, at a rate of 1.0 pound per 100 square feet (0.5 kilogram per nine square meters), into wet paint or as recommended by paint manufacturer. Back roll to encapsulate aggregate into paint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

1. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Notify CITY about anticipated problems when using the materials specified over substrates primed by others.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.

C. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 degrees F.

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Seller's acceptance of substrates and conditions.

F. Scheduling: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying in accordance to manufacturers recommendations.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. Remove and reinstall items after completing painting using workers skilled in the trades involved.

B. Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Surface Preparation Schedule:

NO.	SURFACE	SURFACE PREPARATION
SP-1	Carbon Steel	Solvent or chemical clean, in accordance with SSPC-SP-1
SP-1D	Ductile Iron	Solvent or chemical clean, in accordance with NAPF 500-03-01
SP-2	Carbon Steel	Hand tool clean, in accordance with SSPC-SP-2
SP-2D	Ductile Iron	Hand tool clean, in accordance with NAPF 500-03-02
SP-3	Carbon Steel Fence	Power tool clean, in accordance with SSPC-SP-3
SP-3D	Ductile Iron	Power tool clean, in accordance with NAPF 500-03-03
SP-4	Galvanized Surfaces	Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
SP-6	Carbon Steel	Commercial blast in accordance with SSPC-SP-6 or DIN Sa 2

NO.	SURFACE	SURFACE PREPARATION
SP-6D	Ductile Iron	Abrasive blast in accordance with NAPF 500-03-04
SP-7	Carbon Steel	Brush -off blast in accordance with SSPC-SP-7
SP-8	Concrete Masonry Interior	Apply test patch to determine adhesion. If test patches indicate poor adhesion between the epoxy coating being applied and the existing coatings, abrasive blast all surfaces to be coated leaving only tightly adherent paint and coatings.
SP-8E	Concrete Masonry Exterior	Pressure wash with a solution of No-Rinse Pre-Paint Cleaner from Great Lakes Laboratories & allow to dry
SP-9	Concrete Walls & Floors	Remove contamination, acid etch, and rinse with clear water. Verify required acid-alkali balance is achieved. Allow drying.
SP-10	Carbon Steel	Near White Blast cleaning in accordance with SSPC-SP-10 or DIN Sa 2-½ with 1.0-2.0 profile
SP-12	Plaster Surfaces	Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

3.03 APPLICATION

A. Mix and prepare paint materials according to manufacturers written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

D. Paint exposed surfaces, except where this section indicates that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or

surfaces. If a color of finish is not indicated, CITY will select from standard colors and finishes available.

1. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
2. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

   a. Finished mechanical and electrical equipment.
   b. Light fixtures.

2. Finished metal surfaces include the following:

   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.

3. Operating parts include moving parts of operating equipment
4. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

3.04 FIELD QUALITY CONTROL

A. During the application of dampproofing and painting, ensure that the manufacturer's representative check the dry mil thickness of each coating and certify to the City in writing that the thickness is in compliance with the Specifications. If deficiencies in the dry mil thickness of any coat are found, correct by the application of an additional coat(s) to the said deficient area. The certificate shall also state that all surfaces were properly cleaned prior to the application of dampproofing and paint, specified meetings and inspections were made, the quantity of dampproofing and paint were applied in accordance with their recommendations, and all other requirements stated in the Specifications have been satisfactorily completed.

B. CITY reserves the right to invoke the following test procedure at any time and as often as CITY deems necessary during the period when paint is being applied:

1. CITY may engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of the Seller.
2. Testing agency will perform appropriate tests as required by CITY.
3. CITY may direct Seller to stop painting if test results show material being used does not comply with specified requirements. Seller shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Seller may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by CITY.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 COLOR SCHEDULE: (Manufacturer's names are for reference only)

Generic Name	Industry Designations			Manufacturer Designation		Remarks
	Fed. Std. 959A (1) Color No.	Muncell (2) Color No.	RAL (3) Color No.	Equivalent Color No.	Manufacturer	
Black	27038	N0.5/0.6 %R	9005	C900 IN06	Carboline Tnemec	
Brown				YB23	Tnemec	
Safety Blue	15092	2.5 PB 5/10	5012	S150 SC06	Carboline Tnemec	
Light Green	34524	10 GY 6/10	6018	0365 GB38	Carboline Tnemec	
Safety Green	14120			2383 SC07	Carboline Tnemec	

Generic Name	Industry Designations			Manufacturer Designation		Remarks
	Fed. Std. 959A (1) Color No.	Muncell (2) Col-or No.	RAL (3) Color No.	Equivalent Color No.	Manufacturer	
Dark Grey (Charcoal)				GR32	Tnemec	
Medium Gray	61			2713 IN05	Carboline Tnemec	
Light Gray	26492			0794 GR13	Carboline Tnemec	
Safety Or-ange	12300			6437 SC03	Carboline Tnemec	
Safety Red	11120			5555 SC09	Carboline Tnemec	
White	17925			1864 WH0	Carboline Tnemec	
Safety Yel-low	13591	2.5 Y 8/12	1004	6666 SC01	Carboline Tnemec	

NOTES: (1) United States of America Standard 595B
(2) Muncell Color System by Macbeth Division of Kollmorgen
(3) Royal Academy of Lithography (British)

3.08 PAINTING & COATING SYSTEMS

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

1. Carboline Company, 350 Hanley Industrial Court, St. Louis, Mo. 63144.
2. Sherwin-Williams Company, Cleveland, OH 44101.
3. The TNEMEC Company, Inc.
4. ZRC Worldwide, 145 Enterprise Drive, Marshfield, MA 02050.

B. Systems

SYSTEM	MATERIAL & CONDITION	SURFACE PREP.	PRIMER COAT	INTERMEDIATE COAT	FINISH COAT
C1	Concrete, Interior Floors Normal Service	SP-9	Polyamide-Amine Epoxy (Carboline "Carboguard 1340") 1 coat @ 3.0-4.0 MDF per coat Color: Amber	Waterborne Epoxy Amine (Carboline "Sanitile 555") 1 coat @ 2.0-4.0 MDF per coat Color: Per Painting Schedule	Waterborne Epoxy Amine (Carboline "Sanitile 555") Non-Skid surface 1 coat @ 2.0-4.0 MDF per coat Color: Per Painting Schedule
C2	Concrete, interior chemical containment areas (hydrochloric acid containment area only)	SSPC-SP-13	Sherwin Williams Corobond 100 Epoxy Primer/Sealer 1 coat @ 4-6 mils DFT per coat	Sherwin Williams Kem Cati-Coat HS Epoxy Filler/Sealer, as required to fill voids and bugholes to provide a continuous substrate. 1-2 coats @ 10-20 mils DFT per coat.	Sherwin Williams Cor-Cote E.N. 7000 Epoxy Novolac 1 coat @ 10-14 mils DFT per coat
M 1	Concrete Masonry, Interior Subject to wash-down or moist conditions	SP-8	-	-	Macropoxy 646 FC at 4.0 – 6.0 mils DFT Color: Per Field Painting Schedule
M 2	Concrete Masonry, Exterior				Apply one or more coats of Sherwin Williams SUPER PAINT at 2.0 – 3.0 mils DFT.

SYSTEM	MATERIAL & CONDITION	SURFACE PREP.	PRIMER COAT	INTERMEDIATE COAT	FINISH COAT
S1	Carbon Steel, Interior Normal Service	SP-7	Alkyd Sherwin Williams "Kem Bond HS, B50NZ3" 1 coat @ 2.0 – 5.0 MDF per coat Color: Red	Acrylic Latex Sherwin Williams "Pro Mar 200, B34W200" 1 coat @ 1.7 MDF per coat Color: Per Painting Schedule	Acrylic Latex Sherwin Williams "Pro Mar 200, B34W200" 1 coat @ 1.7 MDF per coat Color: Per Painting Schedule
S2	Carbon Steel, Pre-primed, Interior Normal Service	SP-7	- - -	Sherwin Williams "Pro Mar 200, B34W200" 1 coats @ 1.7 MDF per coat Color: Per Painting Schedule	Acrylic Latex Sherwin Williams "Pro Mar 200, B34W200" 1 coats @ 1.7 MDF per coat Color: Per Painting Schedule
S3	Carbon Steel, Pre-primed, Exterior Normal Service	SP-3	- - -	Acrylic Polymer, Sherwin Williams "Metalatex, B42" 1 coats @ 1.5 -4.0 MDF per coat Color: Per Painting Schedule	Acrylic Polymer, Sherwin Williams "Metalatex, B42" 1 coats @ 1.5 -4.0 MDF per coat Color: Per Painting Schedule
S4	Galvanized Steel, Interior or Exterior-Normal Service	SP-1 or SP-4	- - -	- - -	Zinc Dust, Z.R.C. "Cold Galvanizing Compound" 1 coat @ 2.5-3.5 MDF per coat Color: Light Gray-Flat

SYSTEM	MATERIAL & CONDITION	SURFACE PREP.	PRIMER COAT	INTERMEDIATE COAT	FINISH COAT
S5	Carbon Steel, Exterior Normal Service	SP-3	Alkyd Sherwin Williams "Kem Bond HS, B50NZ3" 1 coat @ 2.0 – 5.0 MDF per coat Color: Red	Acrylic Polymer, Sherwin Williams "Metalatex, B42" 1 coats @ 1.5 -4.0 MDF per coat Color: Per Painting Schedule	Acrylic Polymer, Sherwin Williams "Metalatex, B42" 1 coats @ 1.5 -4.0 MDF per coat Color: Per Painting Schedule
S6	Ductile Iron, Heavy Duty Service	SP-1D	Polyamide Epoxy, Sherwin Williams "Macropoxy 646-100" 1 coat @ 5.0 – 10.0 MDF per coat Color: White	Polyamide Epoxy, Sherwin Williams "Macropoxy 646-100" 1 coat @ 5.0 – 10.0 MDF per coat Color: Per Painting Schedule	Polyamide Epoxy, Sherwin Williams "Macropoxy 646-100" 1 coat @ 5.0 – 10.0 MDF per coat Color: Per Painting Schedule

3.09 INTERIOR PAINT SCHEDULES

A. Structural Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Stairs: Stringers and Treads	S2	Brown	Semi-Gloss	
Stairs: Tread Nosing	S2	Safety Yellow	Semi-Gloss	

B. Building Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Concrete Masonry: Interior:	M1	White	Semi-Gloss	
Concrete Floors Interior, Non-slip:	C1	Medium Gray	Gloss	Refer to § 2.1 E
Pressed Metal Doors & Frames - Interior - -Exterior	 S2 S3	Brown	Semi-Gloss	

C. Safety Related Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Fire quenching equipment and apparatus:	S1	Safety Red w/ White Letters	Gloss	
Safety and first aid equipment when required: - Eyewashes and Safety deluge showers or their location	S1	Safety Green	Gloss	

D. Electrical Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Electrical Components, raceways & conduit.	---	Safety Orange	Semi Gloss	Banding: See Division 26.
Breaker Panels, pre-primed	S2	Matching adjacent surface	Matching adjacent surface	

E. Mechanical Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Pipe hangers and supports: - Galvanized	S4	---	---	Touch-up

F. Process Components

ITEM	PAINT SYSTEM	FINISH COLOR	FINISH SHEEN	REMARKS
Sump Pump Discharge Piping, Bracing, and Supports	S6	Dark Grey	Gloss	

END OF SECTION

SECTION 10 14 23
PANEL SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Engraved plastic and fiberglass signs with 1/32-inch Braille dots for visually-impaired persons.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 08 71 00 – Door Hardware

1.03 REGULATORY REQUIREMENTS

A. Conform to Americans with Disabilities Act (ADA) requirements as they pertain to areas of access for visually-impaired persons.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in accordance with the Specifications.

B. Package signs, labeled in name groups.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is below 70 degrees F. Maintain this minimum during and after installation of signs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Best manufacturing Company – Products: HC300E MP or Fiberglass for Company Room Designations and Type “MP” for Safety/Equipment signs.

1. Interior Room Designation Signs – Laminated colored plastic; in red face color. Size to be 10” x 3” of 1/8-inch thick material. Room names shall be 5/8-inch high standard bold condensed upper case raised white letters. Standard 3/8-inch border and 1/2-inch radius corners; mounted with vinyl foam tape.
2. Exterior Room Designation Signs – Laminated colored fiberglass; in red face color. Size to be 10” x 3” of 1/8-inch thick material. Room names shall be 5/8-inch high standard bold condensed upper case raised white letters. Standard 3/8-inch border and 1/2-inch radius corners; mounted with silicone backing cement and stainless steel one-way screws and expansion shields.

3. Safety/Equipment/Door Signs – Laminated colored plastic; in red face color. Size shall be proportional to message of 1/8-inch thick material. Danger and Safety/Equipment signs to 1-inch high upper case raised white letters. No border or radius corners required; attach Danger and Safety Equipment signs with stainless steel mounting hardware.

    a. Tape Adhesive – Double sided tape with permanent adhesive; 1/16-inch vinyl foam for wall or door mounting.
    b. Signs shall be enlarged if mounted high to enable easy visibility from floor

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instruction.

B. Install signs after doors and surfaces are finished.

C. Mount signs to walls. Coordinate location with City.

D. Clean and polish.

3.03 SCHEDULES

A. Room Designation Signs – Red face color with room names.

B. Provide red "NON-POTABLE WATER – DO NOT DRINK" safety signs at the following locations, if provided:

1. Hose bibs.
2. Yard Hydrants.
3. All other locations providing non-potable or effluent water sources.

C. Provide "CAUTION – EQUIPMENT STARTS AUTOMATICALLY" red safety signs at the following equipment:

1. Chlorine Room pumps

D. Provide red "EXIT" signs above inside face of all exterior doors for the following locations

1. Chlorine Room

E. Provide red “CONFINED SPACE” sign with wording required by MOSH at the following locations:

1. Manway of chemical storage tanks.

F. Chemical Fill Signs (Contractor shall verify pipe sizes prior to production of signs).

1. “SODIUM HYPO, 4” CONNECTION, ADAPTER REQUIRED”.

END OF SECTION

SECTION 11 00 50
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes the requirements for basic mechanical materials and methods to Division 11 and other sections with mechanical equipment requirements, unless otherwise specified.

B. Mechanical Systems: Complete including miscellaneous materials, and ready for operation.

C. The Contractor shall furnish, assemble, install, paint, and test all equipment and appurtenances including electric motors and certain control equipment, as specified under this or other divisions of these Specifications. All equipment furnished shall be in conformance with all pertinent provisions of the General Requirements and as set forth in this and other divisions of these Specifications.

D. Unless otherwise specified, the electric connections and the furnishing and installation of electrical control equipment are included under Division 26 of these Specifications.

E. The work under Division 11 shall include all labor, materials, and equipment for furnishing, installing and testing the piping work described. The work also includes making all connections to pipelines and appurtenances; furnishing and installing all valves, piping, flexible joints, pipe expansion joints and accessories; installation of concrete thrust blocks; furnishing and installation of pipe insulation and heat tracing where required; furnishing and installation of all hangers and hanger supports; and relocation of existing pipelines and appurtenances, as specified in the Specifications and as shown on the Drawings.

F. Although certain construction operations described above are a necessary part of the pipe, valve and accessory installation; the materials and installation specifications may not be included in this Division. The Contractor shall refer to the appropriate sections or divisions of the Specifications for work other than piping and valves which may be related to the work of this Division.

G. The Contractor is advised that making connections to existing pipelines or relocating existing pipelines or appurtenances requires careful consideration as to the construction techniques employed. The Contractor shall be solely responsible for maintaining existing pipelines in such a manner as to prevent disruption of services or prevent bypassing of untreated or partially treated wastewaters directly or indirectly to any water course or underground aquifer.

1.02 QUALITY ASSURANCE

A. Materials and Equipment: Standard products of manufacturers regularly engaged in production of such materials and equipment, unless otherwise indicated.

1. Design: Manufacturer’s latest standard design conforming to these Specifications.
2. When two (2) or more units of same class of equipment are required, use products of same manufacturer.

B. Qualifications:

1. Welders: AWS-certified for the materials to be welded.
2. Structural and Miscellaneous Fabricated Steel Used in Equipment: Except where otherwise specified, conform to AISC standards.

    a. Structural members: Design for appropriate shock and vibratory loads.
    b. Steel partially or totally submerged during operation of equipment: Unless otherwise specified, at least 1/4 inch thick.

3. Materials and Workmanship: Conform to standards of SMACNA.

C. Regulatory Requirements: Comply with requirements of following organizations:

1. NFPA.
2. Plumbing and Gasfitting Regulations of the state of Maryland and the local jurisdiction.

D. Certifications: Ensure that materials and equipment specified to follow requirements of standards organizations that use labels or listings to indicate compliance are delivered to project site with labels or listings attached.

1. The equipment, motors, and all appurtenances shall be designed, manufactured, and tested in accordance with federal, state, and local requirements, and applicable sections of the latest editions of the following codes and standards:

AFBMA	Anti-Friction Bearing Manufacturer's Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Association
UL	Underwriter's Laboratories
NFPA	National Fire Protection Association

E. Materials and Workmanship

1. All materials furnished under this Contract shall be of first-class high-grade quality and of the best workmanship and design, conforming to pertinent specifications of the American Society for Testing and Materials, American Water Works Association and American National Standards Institute, as herein specified or amended. No inferior or low-grade materials will be either approved or accepted, and all work of assembly and

construction shall be done in a neat, first-class and workmanlike manner, based on acceptable practice.

2. All castings shall be clean and sound, without defects of any kind; no plugging, welding or repairing of defects will be allowed. All identical parts of equipment of the same size or capacity shall be interchangeable.
3. All parts entering into the assembly of the equipment are to be designed, constructed and fabricated for continuous and uninterrupted service, so as to eliminate, so far as practicable, the necessity of attention when operating over long periods. Suitable provisions shall be made for easy adjustment or replacement of all parts requiring adjustment or renewal. It is not the intent to give every detail in the Drawings and Specifications. Nevertheless, the Manufacturer shall supply the equipment complete in every detail, so that when assembled and installed at the work site it shall be ready for operation. Shop prints shall be submitted to the Engineer for approval, prior to fabrication of equipment. The Engineer shall approve such submissions for conformance with the design concept and compliance with the information given in the Contract Documents.
4. The Contractor shall be responsible for the dimensions to be confirmed and correlated at the job site, as well as information that pertains solely to the fabrication processes or to techniques of construction and for the coordination of the work of all trades.

1.03 SUBMITTALS

A. Product Data: Submit data for materials other than manufacturer's standard products following Section 01 30 00.

B. Shop Drawings: Include descriptive and published details concerning performance, capacity, and noise ratings for each piece of equipment.

1. Electrical Motor-driven Equipment: Schematic drawing showing coordination with electrical system and furnish:

    a. Rated horsepower.
    b. Full load current requirements.

2. Electric Motors 3/4 Horsepower and Larger: Furnish information on:

    a. Locked rotor current.
    b. Power factor at full and 3/4 load.
    c. Efficiency at full load and rated operation condition.
    d. Type of bearings.
    e. Lubrication requirements.
    f. Net weight.
    g. Catalog data for materials other than equipment that are manufacturer's standard products.

3. Scaled mechanical layout drawings showing:

    a. Dimensioned plan views and elevations of mechanical equipment.
    b. Equipment mounting and foundations, including anchoring details.
    c. Piping and duct work, including support detail.
    d. Components, including space requirements, coordination with building features, and other work.

C. For each and every piece of equipment, furnish complete sets of lubricating instructions, instruction manuals, repair parts lists, assembly drawings, and wiring diagrams describing such equipment and all its appurtenances and accessories with regard to construction, maintenance and repair. Lubricating instructions and maintenance and operation manuals shall be for the specific pieces of equipment furnished in accordance with Section 01782 – Operation and Maintenance Data.

D. The aforementioned submittals must be given to the Engineer in a timely fashion in order that the project will progress in a coordinated fashion. Wiring diagrams associated with equipment must be submitted at the same time so that interconnecting wiring can be developed in time.

E. Quality Assurance/Control Submittals

1. Manufacturers' Instructions:

    a. General: Manufacturer's instructions and recommendations for installation, handling and storage, and cleaning and maintenance of equipment and materials during storage and before initial energizing.
    b. Operation and maintenance manuals for each mechanical system and specific pieces of equipment listed in and following Section 01782 – Operation and Maintenance Data.

F. Certificates:

1. General: Manufacturer's certificates for material and equipment listed.

    a. Pipe, fittings, and valves 8 inch and smaller in diameter.
    b. Pipe, fittings, and valves larger than 8 inch diameter: Follow individual specification sections for submittal requirements.

2. Welding: Evidence that each welder is certified for type of welding required following AWS.

G. Notice to Vendors

1. Vendors who make or take exceptions to the Engineer's plans and/or specifications when writing proposals to contractors must also make note of these exceptions in a covering letter with all submittals (shop drawings).
2. Exceptions not noted will only jeopardize the review of the shop drawings. Exceptions duly noted with detailed explanations will expedite review and return of submittals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Materials and Equipment: Boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage, and clearly labeled with manufacturer's name, brand, or model designation, type or grade, and color.
2. Packing Lists and Bills: Complete packing lists and bills included with each shipment.
3. Tagging and Marking: Each item of equipment tagged or marked with same identification number or mark shown on packing lists and bills of material.

B. Storage and Protection:

1. General: Protect materials and equipment from exposure to elements and keep dry. Handle and store to prevent damage, following manufacturer’s recommendations.

    a. Protect insulation, controls, and electrical equipment from moisture and water damage.
    b. Store pumps, motors, electrical, and other equipment with antifriction or sleeve bearings in weather-tight areas maintained above 60 degrees F.

2. Space Heaters Furnished in Equipment: Connected during storage and operated continuously.
3. Protect equipment and material from rust, pitting, decay, or other deleterious affects from storage and handling.

    a. Repair or replace material and equipment showing such effects or damage, as directed by Engineer.

1.05 PROJECT CONDITIONS

A. General: Drawings indicate extent and general arrangement of equipment, piping, and ductwork.

1. Fit equipment into space allotted and allow adequate clearance for entry, installation, replacement, servicing, and maintenance.
2. Verify actual and final arrangement, location, grades, and elevations of equipment, appurtenances, piping, and ducts before ordering material and equipment.
3. If adjustments and modifications are necessary, submit to Engineer details of such adjustments and modifications and reasons for approval as soon as practicable, but at latest with submittal of scaled mechanical layout drawings.
4. Make no adjustments or modifications without Engineer's written approval.

B. Coordinate the Work so equipment may be moved into place without altering building components, other equipment, or installations.

1. Provide drops, rises, or offsets required for proper installation, whether or not shown on Drawings.

1.06 SAFETY REQUIREMENTS

A. Enclose or provide guards for belts, pulleys, chains, gears, and other rotating parts to protect operating personnel.

B. Guard or cover high-temperature equipment and piping with insulation to protect personnel and prevent fire hazards.

C. Provide items such as catwalks, ladders, and guardrails, where required, for safe operation and maintenance of equipment.

D. Provide safe working space around equipment.

E. Occupational Safety and Health Act of 1970

1. All equipment furnished and installed under this contract must conform to the applicable provisions of the "Occupational Safety and Health Act of l970", including amendments and revisions thereto, and also noise control and abatement regulations of that act.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate sequencing and scheduling of mechanical work with building construction and other related parts of Work, including verification that structures, piping, wiring, conduits, and equipment components are compatible.

1.08 MAINTENANCE MATERIALS

A. Spare Parts and Extra Materials shall be listed in the relevant specification section for equipment or materials.

1. Pack into wooden boxes parts listed to be furnished to the City, and label with:

a. Manufacturer’s name, address, and telephone number.
b. Local representative's name, address, and telephone number.
c. Names of equipment parts are for and list of parts contained therein.

2. Pack extra material in strong cartons, labeled with manufacturer's name, material name, type, color, and location material was installed.
3. Store maintenance material at Engineer’s direction.

1.09 MANUFACTURER'S SERVICES

A. Field Representatives: By manufacturers of furnished equipment during installation, start-up, tests, and to instruct the City Personnel on operation and maintenance of equipment.

B. Availability: Factory-trained service and operating personnel to observe, instruct, guide, and direct Contractor's handling, installation, start-up, and adjustment procedures of equipment.

C. Manufacturer's Services:

1. Inspect equipment installed following manufacturer's instructions before but energizing or operating it and supervise equipment start-up.
2. Before and during required tests, operate and adjust equipment following Contract Documents.
3. When required in specification sections for equipment, instruct City personnel in operation and maintenance of equipment at times and locations approved by Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. In design and supply of equipment, ensure for interchangeability of parts and items for equipment, piping, ductwork, motors, and other appurtenances.

B. Factory assemble, coat, and paint mechanical equipment as much as practicable before shipping and handling with factory-applied prime coat.

C. Nameplate: Attach to each major component of equipment metal nameplate showing manufacturer's name, address, and equipment model number.

2.02 EQUIPMENT BASES

A. Concrete Bases: Unless otherwise indicated, concrete bases shall be a minimum of 4 inches high, following the requirements of Section 03 30 00.

B. Cast Iron or Welded Steel Baseplates: Support each unit and its drive assembly on single baseplate.

2.03 ANCHOR BOLTS

A. Stainless Steel Anchor Bolts, Nuts, and Washers: Type 304, following the requirements of ASTM standards and as indicated on Drawings.

1. Unless otherwise indicated, size anchor bolts to largest diameter that will pass through bolt holes of equipment base.
2. Length of Bolts: To permit minimum 1 inch of grout beneath base plate and minimum of 3 inches anchorage into structural concrete.

B. Template or Setting Drawing for Anchor Bolts, Nuts, and Washers: Furnish sufficiently in advance to permit anchor bolts to be set either before or during structural concrete placement.

C. All anchor bolts shall be set to the dimensions given on the shop drawings and shall be positioned by use of a template. In the case of heavy equipment, it is recommended that anchor bolts for same be set in pipe sleeves and grouted upon completion of equipment installation. Such pipe sleeves shall be used to provide flexibility in the installation. All anchor bolts shall be provided with adjusting nuts and washers for leveling the equipment. Stainless steel anchor bolts and nuts shall be installed for all equipment.

2.04 SUPPORTS AND BRACES

A. Supports and Braces: Fabricate following requirements of the specification sections herein, and as indicated on Drawings.

2.05 COUPLING, BEARINGS, JOURNALS, AND KEYS

A. Couplings: Where specified or required between motor and its driven equipment, use flexible standard self-aligning forged steel coupling.

1. Fix and key 1 hub of coupling to driven equipment shaft with other hub fixed and keyed to abutting drive shaft.
2. Place moisture and dust-proof all metal coupling as close as possible to driven equipment and motor bearings so units are arranged in compact manner.

B. Bearings: Ball or roller type, with both inner and outer races and balls or rollers made from heat-treated steel, and pressure-grease lubricated, except those specifically requiring lubrication.

1. Rollers: Proper size to carry maximum loads without flaking, spalling, or crushing.
2. Balls: Evenly spaced and held in position by continuous spacing or retainer glands.

C. Journals and Bearings: Sized and of proportions to create least wear and overheating under all conditions.

1. Easy Removal and Adjustment: Where required, provisions shall be made for easy removal and adjustments.
2. Journal Lining: When required, lined with babbitt metal hammered into grooves and bored in place.

D. Keys, Nuts, and Other Parts: Secure parts, which may work loose with locking devices.

2.06 FLANGES, JACKING SCREWS, AND EYE BOLTS

A. Flange Boltholes: Drilled with flanges spot-faced on back and stud holes not drilled through.

B. Jacking Screws: For covers, where required.

C. Eye Bolts for Lifting Covers and Equipment: When manual lifting would be difficult, or where required.

2.07 BOLTS, NUTS, AND WASHERS

A. Bolts, Nuts, and Washers: Follow ASTM standards.

1. Nuts: Cold pressed.
2. Bolts, Nuts and Threads: American Standard sizes except those used for flanged pipe, valves, fittings and equipment connections or otherwise noted.

2.08 SAFETY GUARDS

A. General: Cover belt and chain drives, fan blades, couplings, shafts, and other moving and rotating parts on all sides by safety guard following OSHA requirements.

B. Fabrication: Galvanized or aluminum-clad sheet steel or 1/2-inch mesh galvanized expanded metal, 16 gauge or heavier.

C. Design: For easy installation and removal, with necessary supports and accessories including bolts.

1. Outdoor Guards:

a. Design Safety guards in outdoor locations to prevent entrance of rain and dripping water.
b. Safety guards: Follow OSHA requirements.

D. Supports and Accessories, Including Bolts: Galvanized or painted following Section 09900, as required.

2.09 ACCESS DOORS AND PANELS ON MECHANICAL EQUIPMENT

A. Provide access doors and panels for easy access to mechanical components that require periodic maintenance and lubrication.

2.10 LUBRICATION

A. Equipment Lubrication System: Designed for weekly adjustment during continuous operation.

1. Lubrication Facilities, Oil Drains, and Fill Openings: Accessible from normal operating area or platform.
2. Drain Ports: Allow for collection of waste oil in containers from operating area or platform without removing unit from its installed position.

B. Pressure Grease Fittings: Zerk Hydraulic or Alemite type.

1. Location: Accessible for lubricating with grease gun.
2. Hydraulic Grease Guns: Two, each suitable for use with type of grease fittings on equipment.

2.11 SHOP PAINTING

A. Prepare surfaces and shop coat equipment, supports, piping, duct work and appurtenances as specified in Section 09 90 00 and as shown on Drawings, except connecting ends and where it would hinder installation, using shop primer compatible with field coat.

B. Field paint these points after installation.

2.12 SPECIAL TOOLS AND ACCESSORIES

A. Usage: Where required for adjusting, maintaining, or repairing equipment, including special devices for lifting and handling.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Inspect area and surfaces to receive mechanical equipment piping, duct work, and appurtenances, and verify readiness for installation.

B. Before installation, repair defects and damaged area, and adjust surfaces and areas for proper installation.

C. Field measure and verify adequacy of areas to be occupied by mechanical equipment and appurtenances following approved Contractor's Drawings.

D. If adjustment is required, obtain Engineer’s approval and adjust as approved.

3.02 INSTALLATION

A. General:

1. Install equipment and appurtenances following Manufacturer's instructions.
2. Provide complete final connections to equipment, including pipe, duct, electricity, and controls.

B. Isolation Valves and Accessory Fittings: Whether shown or not, install on each side of equipment to allow it to be removed and isolated for servicing.

1. Install manual vents at high points in piping and fitted for hose adapters at low points in fluid piping.
2. Rises and Drops: As required by field conditions.

3.03 FOUNDATIONS, BASES, AND SUPPORTS

A. General: Support equipment, ductwork, electrical conduits, and piping by providing compatible frames, braces, hangers, and anchors.

B. Floor-Mounted Equipment: Unless otherwise shown on Drawings, place floor mounted equipment on reinforced concrete pads minimum of 4 inches high.

C. Horizontal and Vertical Pumps Mounted on Baseplates or Pedestals: Install following Hydraulic Institute Standards and pump manufacturer's recommendations.

1. Leveling of Baseplate or Pedestal: Use shims and/or wedges and anchor raised vibratory absorption concrete pad with anchor bolts set in pipe sleeves.
2. Grouting: Fill space between baseplate or pedestal and concrete pad, and void between anchor bolt and pipe sleeve with quick setting and non-shrink grout.

3. Tighten Bolts: After grout has hardened, tighten anchor bolts to equipment manufacturer's recommendations and cut off bolts not more than 1 inch nor less than 1/2 inch above anchor bolt nut.

D. Vibration Isolators: Install between equipment base and raised concrete pads on other vibrating/rotating mechanical floor-mounted equipment like fans.

E. Heavy-duty Centrifugal Air Compressors and Blowers: Anchor following equipment Manufacturer's recommendations.

F. Non-Vibratory Equipment Suspended Inside Buildings: Brace and support for rigid installation.

1. Supports and Hangers: Attach to bearing walls, roof, and floor supports, or framing members.
2. Cross Bracing: As required to develop rigid installation.

G. Suspended Vibratory Equipment: Braced, supported, and provided with cushioning and anti-vibratory material as shown on Drawings and recommended by equipment Manufacturer.

3.04 ACCESS PANELS AND DOORS FOR CONCEALED EQUIPMENT

A. Access Panels or Hinged Doors: Where necessary for maintenance and servicing of concealed equipment, piping, ductwork, and fans.

3.05 LUBRICATION

A. Lubricate following manufacturer's instructions for initial operation; relubricate following testing and before final acceptance, if directed.

3.06 ADJUSTMENT AND INITIAL OPERATION OF EQUIPMENT

A. Clean: Before systems and equipment are initially started, clean piping, ductwork, and equipment.

1. Moving Parts: Check for freedom of movement, alignment, and adjustment.
2. Remove air-handling units' temporary filters, check permanent filters and replace if dirty or damaged.

B. Manufacturer's Equipment Service: Make adjustments required and recommended by Manufacturer's representative and as required herein, before equipment is energized and operated.

3.07 SURFACE TOUCH-UP/FIELD PAINTING

A. Clean field-installed bolts, nuts, washers, and support systems and paint or coat using materials identical to original shop coat and/or surrounding area.

B. Touch-up other surfaces where shop coats have been damaged, using paint, coatings, and film thickness identical to original shop coats.

C. Field Paint: Specified in Section 09 90 00 and shown on Drawings.

3.08 CLEANING AND PROTECTION

A. Clean equipment, surrounding area, and ductwork inside and out.

B. Protect equipment during and after installation from construction dust and debris.

C. Provide temporary protection as required until equipment is in operation or until receipt of Certificate of Substantial Completion.

3.09 FIELD QUALITY CONTROL

A. Demonstrate and test operation of systems and equipment for specified requirements in Engineer’s presence as specified for equipment in specific sections and in accordance with Section 01 65 00.

B. Make adjustments and replace defective equipment and parts, as required.

3.10 OPERATION INSTRUCTIONS

A. After systems have met field quality control requirements, and before issuance of Certificate of Substantial Completion, furnish manufacturer's services for operation and maintenance, as specified for equipment in specific sections.

3.11 GUARANTEE

A. Equipment furnished under this Contract shall be guaranteed by the Contractor to perform the service for which it is required in full compliance with the Specifications, per the terms and conditions of the General Conditions. The Contractor shall, at his own expense, correct and repair promptly any and all breaks, failures or wear in the equipment and any component associated therewith which was furnished integral with the equipment by the manufacturer.

3.12 DEFECTIVE WORK

A. Any material found by the Engineer to be unsuitable, and not in conformity with these specifications, as to quality of workmanship or operation, shall be removed from the site of the work.

B. If any equipment, or part thereof, is found defective prior to the expiration of the guarantee period, the Contractor shall, notwithstanding the fact that such work or materials may have been previously accepted or estimated for payment, correct all defects in a manner satisfactory to the Engineer.

3.13 DEMOLITION AND DISPOSAL OF USED AND SURPLUS EQUIPMENT AND MATERIALS

A. Any equipment and materials removed from existing installations as part of modifications hereinafter described under other sections, unless they are to be reused as may be specified or noted on the Contract Drawings, or unless the Engineer advises that the City wishes to retain them, shall be removed from the job site and disposed of at no additional cost to the City.

B. Equipment and material to be retained by the City shall be dismantled and placed in an area of the treatment plant by the Contractor as directed by the Engineer.

END OF SECTION

SECTION 11 24 00
CHEMICAL FEED SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The Chemical Feed System shall be compatible for use with 15% sodium hypochlorite.

B. Chemical Metering Pumps shall be positive displacement pumps of the peristaltic tubing type. This specification addresses skid mounted chemical metering pump systems complete with the skid assembly containing chemical metering pumps, all necessary piping, valves, fittings, supports, electrical controls, and accessories as specified herein. The metering pump skid shall contain the following items:

1. Skid with drip lip
2. Metering pumps with adjustable stroke length adjustment
3. Calibration column
4. Pulsation dampeners
5. Pressure gauges with diaphragm seals
6. Ball valves
7. Pressure relief valves
8. Backpressure valves
9. Flow Monitors
10. All piping, valves, gaskets, supports, hardware, wiring, and accessories necessary for a fully functioning skid.

C. Equipment of a different type, size, weight or design of that specified herein can be offered. However, such equipment shall be acceptable only on the basis of the following.

1. Any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc., required to accommodate such a substitution shall be made at no additional cost to the City.
2. Changes in scope of equipment and performance thereof shall be the responsibility of the Contractor.

3. All modifications to the scope shall be approved by the Engineer and must be determined to be the equal of that specified.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. American National Standard Institute (ANSI)

2. Occupational Safety and Health Administration (OSHA)

3. National Electrical Manufacturers Association (NEMA)

4. National Electrical Code (NEC)

5. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11 00 50 – Basic Equipment Materials and Methods

B. Section 11 24 40 - Chemical Metering and Transfer Pumps

C. Section 11 24 10 – Polyethylene Chemical Storage Tanks

1.05 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01 33 00 Submittal Procedures, and Section 01 78 39 Project Record Documents.

B. Product Data:

1. One (1) electronic copy of submittal data will be supplied for the system.

2. Component data and shop drawings of the system will be supplied, including dimensions, weight, and parts list.

3. When applicable control panel elevation, control schematics and component data will be supplied.

C. Record Documents: Manufacturer's warranty form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

D. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01 77 00, Closeout Procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer shall have minimum ten (10) years' experience in manufacturing Chemical Feed Systems.

B. All equipment provided under this section shall be obtained from a single supplier or manufacturer who shall assume full responsibility for the completeness and proper installation of the Chemical Feed System.

C. To insure quality and unit responsibility, the Chemical Feed System must be assembled and tested by the manufacturer at its facility and be a standard regularly marketed product of that manufacturer. The manufacturer must have a physical plant, technical and design staff, and fabricating personnel to complete the work specified. Skids assembled by a second party fabricator, integrator or contractor shall not be acceptable.

D. Prior to shipment the Chemical Feed System shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connection whisker-free. The Chemical Feed System shall be tested under pressure for a minimum of one hour at 100 psi. If leaks are found they shall be fixed and a new test shall be conducted for an additional hour at 100 psi until the Chemical Feed System is verified to be leak free.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. The feed system shall be specially designed, constructed and installed for the service intended and shall comply with the conditions listed in the schedule in Section 2.02 below. The vendor shall submit compatibility data from the manufacturer being supplied to confirm the materials of construction

C. The skid mounting of the metering pumps shall conform the following requirements:

1. Each chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site on a single skid. Components to be mounted on the skid are as indicated on the drawings and shall include the metering pumps, calibration column, piping, valves, piping accessories (pulsation dampeners, strainers, etc.), and wiring integral to the skid. The chemical feed system supplier shall be responsible for providing all equipment, valves and piping within the skid boundary.

2. The skids shall be constructed of a minimum 3/8" thick fusion welded polypropylene sheets with adequate supports for all equipment and piping. Fork lift truck cut outs be provided. The polypropylene material shall be UV protected and shall be suitable for either floor or wall mounting as specified below or in project drawings.

3. All components of the skid-mounted system (pumps, piping and controls) shall be tested prior to shipment as described in Part 1.06.D.

4. Skid shall place all metering pumps 3.5 feet above the finished floor in the chlorine spill containment area for pump protection and accessibility. Pump skids shall be coordinated between the Contractor and pump manufacturer to ensure final placement of pumps.

D. Calibration Chamber: Provide one, clear plastic calibration chamber with vent for use in calibrating the metering pumps.

1. The chamber shall be sized to give adequate capacity for a minimum 60 second draw down test.

2. The scale shall give direct readings in GPH without the need for calculations.

3. The calibration chamber shall be piped and valved so that each pump shall be able to utilize the calibration chamber without interfering with the operation of the other pumps.

4. The top of the chamber shall have a fitting to allow for piping to a common vent.

E. Pulsation Dampeners:

1. Pulsation dampeners shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps. The pulsation dampener shall dampen flow pulsations a minimum of 95 percent.

2. Pulsation dampeners shall be provided with valves, gauges and fittings necessary for maintaining required air pressure in the air chamber.

3. Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.

4. Provide one dampener on the discharge side of each metering pump.

5. Each pulsation dampener shall include an integral pressure gauge.

F. Piping, Valves and Appurtenances:

1. All pipe, molded fittings, valve end connectors and fabricated piping components shall be made of Schedule 80 PVC. Cement shall be as recommended by the pipe manufacturer for the services outlined in this Section.

2. Tru-union Isolation valves shall be vented and provided for isolation of major equipment. Seals shall be compatible with the chemical being pumped.

G. Back Pressure and Pressure Relief Valves

1. Provide one type of each valve for each metering pump.

2. Valves shall be spring-loaded, diaphragm-type, with materials of construction compatible with chemical service.

H. Wye Strainer

1. Provide one type on the system.

2. Strainer shall protect piping system with 1/32" perf screen. Strainer shall be made of materials of construction compatible with chemical service.

I. Metering Monitor

1. Provide one flow monitor for each metering pump.

2. Metering monitor shall be ProMinent Fluid Controls PVDF/Viton type III or approved monitor provided by metering pump manufacturer. Unit shall directly connect to the top of the metering pump discharge check valve and be electrically connected directly to the face of the metering pump.

J. Motorized Ball Valve

1. All valve end connectors and fabricated piping components shall be made of Schedule 80 PVC. Cement shall be as recommended by the pipe manufacturer for the services outlined in this Section.

2. Tru-union isolation valves shall be vented and provided for isolation of major equipment. Seals shall be compatible with the chemical being pumped.

3. Motorized Ball Valve shall be Asahi Quarter Master 94, Series 120V, 1 phase, 60 Hz. or equal.

2.02 CHEMICAL FEED SYSTEMS REQUIRED

QTY	**1**
Service (Chemical)	**SODIUM HYPOCHLORITE**
Chemical Concentration	**15%**
Specific Gravity	**1.20**
Temperature	**60-70 F (CLIMATE CONTROLLED)**

Feed Rate	**5 GPH**
Pressure at Injection Point	**0 – 20 PSIG**
No. of Discharge Points	**6**

2.03 METERING PUMPS

A. General

1. Pump construction and features vary as a function of the pump flow output range. See paragraph 2.02.B above for pump flow range requirements and see paragraphs below for pump specific design features.

2. The pump shall be designed for leak-proof operation and trouble-free performance.

3. Reference Section 11 24 40 for transfer and metering pump specification requirements.

2.04 SYSTEM DESCRIPTION

A. General

1. All wetted surfaces of feed pumps and all sealing gaskets shall be suitable for continuous exposure to chemical service shown on the pump schedule.

2. All wetted surfaces shall be of materials suitable for contact with potable water and shall not leach out any organic or inorganic constituent that is not permitted by local or federal regulations.

B. Controls - Metering Pump SCADA Interface Control Panel

1. The SCADA Interface Control Panel shall be provided by the metering pump manufacturer.

2. Coordinate panel communication over Ethernet with the system integrator. Refer to electrical drawings.

3. Metering pump control shall be achieved via a NEMA 4X polycarbonate control panel suitable for interfacing with the plant SCADA system.

4. Metering pump control panel shall be configured to provide both ethernet connectivity and Modbus/TCPIP connectivity.

5. The SCADA Interface Control Panel Shall be configured with

   a. Main circuit breaker (120VAC 1ph, 60hz power) suitable for the overall system load

   b. Circuit breaker for each pump

c. H/O/A selector switches for each pump

d. P-16 digital process controllers for each pump for local 4-20mA control of the pump when the panel is in local mode

e. Alarm pilot lights for each pump

f. Misc terminals, relays as required

6. The SCADA Interface Control Panel shall offer the following inputs

a. Analog (4-20ma) speed command for each pump

b. Digital (on/off) run command for each pump

7. The SCADA Interface Control Panel shall offer the following outputs

a. Digital (on/off) run status for each pump

b. Digital (on/off) alarm status for each pump

c. Digital (on/off) in-remote status for each pump

d. Analog (4-20ma) speed indication for each pump

8. The panel shall be UL 508 rated and shall be fabricated by the chemical skid manufacturer and tested with the chemical feed skid prior to shipment to the site.

2.05 MANUFACTURER

1. ProMinent Fluid Controls, Inc. or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. The equipment shall be installed per the contract documents and manufacturer's recommendations.

1. Provide a manufacturer's certificate showing the equipment has been satisfactorily calibrated and tested.

2. An authorized manufacturer's representative shall inspect the installation of all work furnished under this section and shall provide a certificate of proper installation.

3.02 MANUFACTURERS SERVICES

A. The manufacturer or manufacturer's representative shall provide the services of an experienced, authorized representative the equipment specified herein who shall be present at the jobsite and/or classroom designated by the City/District for the minimum man-days listed for the services shown below time travel excluded

1. One man-day per site for inspection, start-up, functional testing and certificate of proper installation.

2. One man-day per site for training and commissioning.

3.03 WARRANTY

A. The chemical metering pump manufacturer shall provide a two-year warranty on the metering pump mechanical drive and one year on the liquid end and pump accessories from date of start-up.

END OF SECTION

SECTION 11 24 10
POLYETHYLENE CHEMICAL STORAGE TANKS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all a vertical, high density cross-linked polyethylene tanks and accessories per section 2.05, complete and in place, in accordance with the Contract Documents.

B. Unit Responsibility: The Contractor shall be responsible for furnishing the vertical tank(s) and its accessories for the chemical storage as noted.

C. This section includes the equipment necessary for the following materials:

1. 15% Sodium Hypochlorite

D. Included under this section are tanks and appurtenances. Metering pumps, transfer pumps, instrumentation equipment, control, chemical feed piping and valves, and electrical work associated with chemical feed systems are specified in other sections.

1.02 RELATED WORK

A. Section 11 24 00 – Chemical Feed Systems

B. Section 11 24 40 – Chemical Metering and Transfer Pumps

C. Section 33 10 60 – Plastic Piping Systems

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be approved by the engineer or contractor prior to the manufacturing of the vertical tank(s). Submit the following as a single complete initial submittal. Sufficient data shall be included to show that the product conforms to Specification requirements. Provide the following additional information:

1. Vertical Tank and Fitting Material

   a. Resin manufacturer data sheet
   b. Fitting material
   c. Gasket style and material
   d. Bolt material

2. Dimensioned Tank Drawings

a. Location and orientation of openings, fittings, accessories, restraints, and supports.
b. Details of manways, flexible connections, and vents.

3. Calculations

a. Tank restraint system. Show seismic and wind criteria.

B. Manufacturer's warranty

C. Manufacturer's unloading procedure

D. Manufacturer's installation instructions

E. Supporting information of Quality Management System.

F. Supporting documentation of Manufacturer's certification to NSF/ANSI Standard 61 – Drinking Water System Components for water treatment chemicals.

G. Manufacturer's Qualifications: Submit to engineer a list of 5 installations in the same service as proof of manufacturer's qualifications.

H. Factory Test Report

1. Wall thickness verification.
2. Fitting placement verification
3. Visual inspection
4. Impact test
5. Gel test
6. Hydrostatic test

1.04 QUALITY ASSURANCE

A. The Contractor shall provide a vertical tank of high-density cross-linked polyethylene. Tanks furnished under this Section shall be supplied by Poly Processing Company or approved equal who has been regularly engaged in the design and manufacture of chemical storage tanks for over 10 years.

B. Tanks shall be manufactured from virgin materials.

C. Tanks shall be manufactured from materials certified to NSF/ANSI Standard 60 for chemical storage and submit form from NSF supporting chemical certification.

D. The warranty shall be provided by the Contractor for the specific service application.

1.05 REFERENCES

A. ASTM D638 Standard Test Method for Tensile Properties of Plastics

B. ASTM D883 Standard Definition of Terms Relating to Plastics

C. ASTM D1505 Density of Plastics by the Density-Gradient Technique

D. ASTM D1525 Vicat Softening Temperature of Plastics

E. ASTM D1693 ESCR Specification Thickness 0.125" F50-10% Igepal

F. ASTM F412 Standard Terminology Relating to Plastic Piping Systems

G. ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

H. UBC Code: International Building Code, IBC 2009

I. ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure)

J. NSF/ANSI Standard 61, AWWA – Drinking Water System Components

K. ASTM D-1998 Standard Specification for Polyethylene Upright Storage Tanks

1.06 WARRANTY

A. In addition to the guarantee period of the General Conditions, all storage tanks shall have a three (3) year full replacement warranty against failure due to defects or corrosion. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. At completion and acceptance of tank installations, the Contractor shall assign the tank warranty to the City . The Contractor shall also provide the City with information on extended warranties available for purchase from the tank manufacturers.

PART 2 – PRODUCTS

2.01 GENERAL

A. Tanks shall be rotationally-molded, vertical, high density cross-linked polyethylene, one-piece seamless construction, cylindrical in cross-section and vertical with flat bottoms. Tanks shall be adequately vented as prescribed in tank manufacturer's technical bulletin, venting-design for ACFM (air cubic feet per minute). Where indicated, tanks shall be provided with ancillary mechanical and serial numbers must be permanently embossed into the tank.

2.02 MANUFACTURER

A. Tanks shall be manufactured by Poly Processing Company or approved equal.

2.03 POLYETHYLENE STORAGE TANKS

A. Service: Chemical storage tanks shall be suited for the following operating conditions:

1. (2) 2,650-Gal Bulk Tanks (22 days of storage)
2. (1) 230-Gal Day tank

B. High Density Cross-linked Polyethylene resin used in the tank manufacture shall be Poly CL or approved equal and shall contain ultraviolet stabilizer as recommended by resin manufacturer. Where black tanks are indicated, the resin shall have a carbon black compounded into it. The tank material shall be rotationally molded and be a resin that is commercially available at the time of tank manufacture.

C. For sodium hypochlorite, tank resin shall include an antioxidant polyethylene system (OR-1000) with four times the antioxidant properties of a standard polyethylene bonded to the interior surface during the manufacturing process.

D. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. In NO case shall the tank thickness be less than design requirements per ASTM D 1998.

1. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

$T = P \times OD/2SD$ or $0.433 \times SG \times H \times OD/2SD$

Where:

T	=	wall thickness, in.
P	=	pressure, psi
SG	=	specific gravity, gm/cc
H	=	fluid head, ft
OD	=	outside diameter, ft
SD	=	hydrostatic design stress

a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187” thick.

2. On closed top tanks the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.

3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

Tank Diameter, ft	Min Knuckle Radius, in
less than or equal to 6	1
greater than 6	1-1/2

a. Unless otherwise indicated by Contract drawings, for indoor pneumatic fill, manways shall be 24-in. diameter or greater and equipped with an emergency pressure relief device or manway with pressure relief at 6" water column to prevent over-pressurization. The manway shall be chemically compatible with the chemical being stored. Gaskets shall be closed sell, cross-linked polyethylene foam, Viton, or EPDM materials.

b. Unless otherwise indicated by Contract drawings, for outdoor pneumatic fill, manways shall be 24-in. diameter or greater and equipped with Poly Processing Company's F.S.2650 combined manway and vent or approved equal to prevent over pressurization of tank. Manway must be capable of relieving a volume flow rate of up to 2,650 ACFM. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

c. Unless otherwise indicated, tanks less than 2,000 gallons in non-pneumatic applications shall have a manway cover 17-in. or smaller of Polyethylene material with a coarse thread. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

NOTE: Tanks must be vented to allow for performance at atmospheric pressure, in accordance with the following matrix:

Venting Requirements For Polyethylene Tanks									
Mechanical Pump Fill	**Pneumatic Fill**								
IF ≤ 1000 gallons	**IF** - Vent length ≤ 3 feet			**IF -** Vent length > 3' and ≤ 30'			**IF** - Scrubber Application		
Vent size should equal size of largest fill or discharge fitting	**AND - Vent** screen mesh size ≥ 1/4" or no screen used			**AND -** 3 or less 90° elbows with no other restrictions or reduction in pipe size			**Vent pipe size throughout scrubber system CANNOT be reduced!** Centerline of dispersion pipe not to be submersed > 6 inches		
IF > 1000 gallons	**Emergency Pressure Relief Cover Required**			**Emergency Pressure Relief Cover Required**			Perforated dispersion pipe must be same diameter or larger, as vent. Sum of perforations ≥ cross sectional area of pipe		
Vent size should exceed the largest fill or discharge fitting by 1 inch	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size
	2"	2"	4"	2"	2"	6"	2"	2"	6"
	3"	2"	6"	3"	2"	6"	3"	2"	8"
	3"	3"	6"	3"	3"	8"	3"	3"	10"

(2) 2 inch vents **DO NOT EQUAL** 4 inch venting capacity rev. Nov 2006

For detailed venting guidelines, please visit our Technical Resources at www.polyprocessing.com

E. Tank colors shall be natural (unpigmented) or as specified by the engineer with written agreement by the tank manufacturer.

2.04 TANK ACCESSORIES

A. Ladder:

1. Fiberglass access ladders shall be provided with the polyethylene chemical storage tanks at locations as shown. Safety cages shall be added to ladders as required, per OSHA.

2. Ladders must be secured to the tank and secured to the concrete to allow for tank expansion/contraction due to temperature and loading changes. Use proper chemical resistant materials when anchoring to tank dome or sidewall.

3. All ladders shall be designed to meet applicable OSHA standards. Reference: OSHA 2206; 1910.27; fixed ladders.

B. Restraint System:

1. Metal components to be stainless steel edge softeners, and tension ring with stainless steel cables and clamps.

2. Tank restraint system shall be supplied and the design of the same certified by a structural engineer registered in the State of tank installation. Design shall conform to the most recent edition of the IBC code for seismic and wind load.

Anchor bolts as required by the calculations shall be supplied by the tank manufacturer.

2.05 TANKS

A. Tank Schedule per the following specifications:

	Quantity	Nominal Capacity	Approx. O.D.	Approx. Height	Ladder Height
Bulk Tank	2	2,650 Gal	8’-0”	8'-9 1/4"	8’
Day Tank	1	280 Gal	2-10”	7’-1/2”	6’

Note 1: Approximate overall height is measured along the straight cylindrical portion of the tank and includes the dome top.
Note 2: Ladder Height is measured from bottom of tank.

B. Fittings

1. Tank fittings shall be provided in accordance with the drawings. Threaded fittings shall use American Standard Pipe Threads. If tanks are insulated, fittings shall be installed at the factory prior to application of the insulation.

2. Bolted flange fittings shall be constructed of one 150 lb. flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets. Stud bolts to have chemical resistant polyethylene injection molded heads and gaskets to provide sealing surface between the bolt head and the interior tank wall. Stud bolt heads are to be color coded for visual ease of identifying the bolt material by onsite operators. Green- 316 Stainless Steel, Black- Titanium, Red- Alloy C-276, Blue- Monel. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

3. For sodium hypochlorite, Bolted One-Piece Sure Seal (B.O.S.S.), double flange fittings constructed of virgin polyethylene shall be supplied. Bolts will be welded to a common backing ring and encapsulated with polyethylene prevent fluid contact with the metal material. Flange will have one full face gasket to provide a sealing surface against inside tank wall. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

4. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at 6-ft max intervals. Own pipes and fill pipes shall be PVC or material compatible with the chemical stored.

5. U-Vents: Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(b)(4)(ii). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen if required (Insect screen lessens the vent capacity by 1/3) in accordance with the venting schedule listed above.

6. All fittings on the 1/3 lower sidewall of tanks with capacities ≥ 1,000 gallons shall have 100% virgin PTFE Flexijoint® expansion joint or approved equal. Expansion joint to have a minimum of 3 convolutions, stainless steel limit cables, and FRP composite flanges. Galvanized parts will not be accepted.

7. Expansion joint to meet the following minimum performance requirements:

   Axial Compression ≥ 0.67”
   Axial Extension ≥ 0.67”
   Lateral Deflection ≥ 0.51”
   Angular Deflection ≥ 14°
   Torsional Rotation ≥ 4°

2.06 LEVEL INDICATION

A. Each tank shall be provided with a radar level indicator and a backup float indicator.

B. Float Indication: The level indicator shall be assembled to the tank and shall consist of PVC float, indicator polypropylene rope, perforated interior pipe, PVC roller guides, clear UV resistant PVC sight tube EnviroKing by C.F. Harvel, and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time. Indicator shall be neon orange color for visual ease for onsite operators.

C. Radar Level Indicator: Refer to 26 95 00 Field Instruments for details.

2.07 FACTORY TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.

2. Degree of Crosslinking. Use Method C of ASTM D 1998 – Section 11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998. Fitting placement tolerance shall be +/- 1/2-in. and +/- 1 degree radial.

2. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.

3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Tanks shall avoid sharp objects on trailers.

B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.

C. Upon arrival at the destination, Contractor shall inspect the tank(s) and accessories for damage in transit. If damage has occurred, tank manufacturer shall be notified immediately.

3.02 INSTALLATION

A. Tank installation shall be in strict accordance with tank manufacturer's installation manual and shop drawings.

B. Installation shall be inspected by tank manufacturer to verify system flexible connections, venting and fittings are properly installed. In addition to on-site inspection, tank system(s) to be reviewed using tank manual check list as supplied by manufacturer.

C. Manufacturer to provide 1 hour training session to prepare operators to service and maintain the tank system. Included in training session will be training manuals.

D. Manufacturer's trained technician to do an onsite inspection of installation. Inspection will verify chemical application, plumbing connections, venting, and applicable ancillary equipment such as ladders, restraints, etc. A verification or proper installation certificate will be supplied when equipment passes installation checklist.

E. Tank manuals will consist of installation check lists, tank drawing(s) as built, fitting drawings referencing nozzle schedule on tank drawing, materials of construction, and recommended maintenance program.

3.03 FIELD TESTING

A. Tanks shall be hydro-tested for 24 hours prior to commissioning. Prior to filling bulk storage tanks, batch and day tanks with appropriate chemicals, each tank shall be filled with water for a period of at least 7 days in order to ensure each tank is watertight. If any tank leaks, it shall be replaced or repaired by a factory trained representative to the satisfaction of the CITY and retested until no leakage occurs.

END OF SECTION

SECTION 11 24 40
CHEMICAL METERING AND TRANSFER PUMPS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all labor, materials and equipment required to furnish, install, test, calibrate and place into satisfactory operation, the chemical metering and transfer pumps with the necessary appurtenances as described herein and as shown on the Contract Drawings. All equipment materials that come in contact with the chemicals being handled shall be resistant to attack from those chemicals.

B. This section includes the equipment necessary for the following chemicals:

1. 15% Sodium Hypochlorite

C. Included under this section are metering and transfer pumps and appurtenances. Storage tanks, instrumentation equipment, control, chemical feed piping and valves, and electrical work associated with chemical feed systems are specified in other sections.

1.02 RELATED WORK

A. Section 11 00 50 – Basic Equipment Materials and Methods

B. Section 11 24 00 – Chemical Feed Systems

C. Section 11 24 10 – Polyethylene Chemical Storage Tanks

D. Section 33 10 60 – Plastic Piping Systems

E. Division 26 – Electrical

1.03 SUBMITTALS

A. Shop drawing submittals shall be furnished for all pieces of equipment specified under this section in accordance with Division 1 of these specifications.

B. For shop drawing review, the pump manufacturer shall submit the following:

- Complete parts lists, including materials of construction and weights;
- Pump exploded view and dimensional drawings;
- Characteristic performance curves showing flowrate as a function of RPM and pressure;
- Motor data and VFD data as necessary;

- Control panel data;
- Chemical Compatibility Certification - the manufacturer shall provide a written certification with the shop drawing submittal certifying that the pumps and tubing are fully suitable and intended for use with the chemicals to be handled; and
- O&M Manual, including programming and wiring instructions
- Manufacturer Warranty

C. The manufacturer of the chemical feed metering pumps is responsible for meeting the requirements of this specification and related work specified elsewhere. In addition, they shall coordinate operation of their equipment with the Contractor including but not limited to:

1. Providing any and all information on the performance/characteristics of their equipment.
2. Providing wiring and installation diagrams, operational and shutdown interlocks, and ancillary controls.
3. Providing shop drawings, parts lists, materials of construction, tolerance, coatings, and certification of compliance with generally accepted standards.

1.04 REFERENCES

A. Electric motors of all pumping equipment specified herein shall meet all applicable standards of the Underwriter's Laboratories, the National Electrical Manufacturer's Association and the National Electric Code.

1.05 WARRANTY

A. The chemical metering pump manufacturer shall provide a two-year warranty on the metering pump mechanical drive and one year on the liquid end and pump accessories from date of start-up.

B. The chemical transfer pump manufacturer shall provide a one-year warranty from date of start-up.

PART 2 – PRODUCTS

2.01 GENERAL MATERIALS

A. All materials that are exposed to the chemicals being handled shall be resistant to attack from those chemicals. In the case of equipment available with alternate or optional materials, only those materials carrying the manufacturer's highest rating for the application shall be used.

B. All products furnished under this Section shall be new and unused. The products shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. Equipment used in each chemical feed system shall be compatible with the chemical used.

D. All equipment and wetted components shall be NSF-61 approved.

E. Pump skids shall be coordinated between the Contractor and pump manufacturer to ensure placement of transfer and metering pumps a minimum 3.5 feet above the finished floor in the chlorine spill containment area for equipment protection and accessibility.

F. Refer to 11 24 00 for chemical feed metering pump system requirements.

2.02 SODIUM HYPOCHLORITE METERING/FEED PUMPS

A. General Requirements (Design Basis):

Number of Pumps	Seven (7) w/common suction (6 duty, 1 standby)
Pump Type	Peristaltic Hose
Capacity	5.0 gph against max. 60 psig
Piping Material	SCH 80 PVC/Viton
Suction/Discharge Connection	1" Socket Weld/ NPT w/ 0.5" isolated discharge lines to each feed point

A. The chemical metering pumps shall be of the peristaltic pump type. The pump shall suitable for use with 15% sodium hypochlorite.

B. Peristaltic tubing pumps must be positive displacement, direct-coupled pumps, utilizing a flexible tube with a rotating two (2) roller design.

C. The pump must be capable of operating in either direction as well as operating in a "run dry" situation with no damage to the pump and tube. The pump will be designed for quick and easy tube replacement and shall not require the replacement of the entire liquid end to facilitate a tubing change.

D. The pump housing shall be corrosion resistant and be rated IP 66 / Nema 4X for indoor operation.

E. Each pump shall be capable of self-priming and when completely dry, the peristaltic pump must have a lift capability of up to 27 feet.

F. The pump liquid end must have four (4) mounting configurations; Right, Left, Top, and Bottom, to allow for flexibility in customer connections.

G. The power supply to the pump shall be universal and shall accept Voltages from 100 to 240 Volts without modification. Power cords shall be supplied to meet customer power requirements.

H. Pumps shall be supplied with an optical hose rupture indicator.

I. The pumps shall be supplied with FDA compliant PTFE seals.

J. The pump shall have a relay output to indicate fault conditions.

K. Additional options may include a second pacing relay contact or a 4-20mA output that is proportional to pump output.

L. The pump shall be capable of being controlled via either manual operation or 4-20mA control signal.

M. The pump shall have an integrated 1-week/1-month timer for flexible automated control.

N. A control shall be provided for the sodium hypochlorite metering pumps. This panel will communicate to PLC-7 via Ethernet.

O. The pumps shall be DulcoFlex Control DFXa, peristaltic tubing pump as manufactured by Prominent Fluid Controls, Inc., or approved equal.

2.03 SODIUM HYPOCHLORITE TRANSFER PUMPS

A. Provide a duplex (2) pump system (1 duty and 1 standby) for conveyance of sodium hypochlorite from the bulk tanks to the day tank, or for recirculation back to either bulk tank.

B. Transfer pumps shall be end suction self-priming constant speed pumps each with a design capacity of 10 gpm at 10 ft TDH and a minimum suction lift capacity of 5 ft. All pump head components shall be compatible with 15 % sodium hypochlorite.

C. Sodium hypochlorite transfer pumps shall be constructed with ETFE casing with FKM O-rings, PTFE bearing, ceramic spindle. Pump shall be fitted with high gravity magnets to accommodate specific gravities up to 1.83. Pump shall be provided with integral priming chamber, and non-contract bearing design rated for dry-run operation.

D. Pump shall be Iwaki model SMXF-221 or approved equal. Two (2) transfer pumps shall be provided.

E. Provide one complete wet end as a shelf spare part.

F. A control panel shall be provided for the sodium hypochlorite transfer pumps. This panel will communicate to PLC-7 via Ethernet. Refer to electrical drawings.

2.04 SODIUM HYPOCHLORITE SUMP PUMP

A. Provide one (1) submersible pump for conveyance of sodium hypochlorite from the sump to a dedicated sodium hypochlorite discharge connection. Operation of the sump pump shall be manual. Sump pump shall have a capacity of 30 gpm at 6 ft TDH.

B. Pump components shall be compatible with use of 15 % sodium hypochlorite.

C. Pump housing shall consist of non-corrosive aluminum outer casing. Static seals shall be leakproof Nitrile rubber O-rings in precision machined grooves with controlled compressions.

D. Shaft shall be stainless steel ANSI 420.

E. Motor shall be air filled, NEMA Design B with Class F insulation; two-pole, 3400 rpm, shrink-fit to the motor housing, and allow up to 15 starts per hour.

F. Bearings shall be of an upper and lower single row ball bearing.

G. Shaft seals shall be independent double face seals running in FDA approved lubricant. Upper seal shall be carbon/ceramic. Lower seal shall be silicon carbide/silicon carbide.

H. Impeller shall be multivane, open type made of polyurethane material.

I. Diffuser shall be Nitrile Rubber.

J. Strainer shall be Hard EPDM rubber.

K. Sump pump shall be Flygt Ready 8 Submersible Pump as manufactured by Xylem Flygt or approved equal.

PART 3 - EXECUTION

3.01 GENERAL CHEMICAL FEED EQUIPMENT INSTALLATION

A. All equipment shall be set, leveled, and aligned in strict accordance with the manufacturer's instructions.

3.02 TESTING / START-UP SERVICES

A. Field Pump Tests: Contractor shall provide a factory trained service representative to perform the following services for chemical metering pump equipment:

1. Check proper installation of each piece of equipment including wiring and piping and make recommendations to Contractor for required changes to make equipment fully operational.
2. Check calibration of each component and make adjustments as necessary.
3. Each pump shall be tested with all associated instruments, valves and piping installed.
4. Each pump shall be tested with plant water at maximum and minimum operating capacities. The rated motor nameplate current and power shall not be exceeded at any point with the specified range.
5. Calibration curves shall be developed for each pump using plant water. Curves for each pump shall be at 100%, 75%, 50% and 25% speeds, with a minimum of four (4) stroke length setting per speed setting. The discharge pressure setting shall be the minimum discharge pressure setting as listed in the Chemical Feed Pump Schedule. The Contractor shall notify the Engineer five (5) days prior to each test. The Engineer reserves the right to witness these field calibration tests.
6. For each pump, record armature voltage for a minimum of five (5) pump speeds.
7. Each pump shall be calibrated in accordance with the requirements in item (5) above, using its associated chemical upon plant startup.
8. Check and adjust as necessary to provide proper operation.
9. Provide adequate operation and maintenance information. The operation and maintenance manuals for each item shall be provided in addition to any instructions or parts lists packed with or attached to the equipment when delivered.
10. The above services are to be performed without limit of time or restrictions as to the number of trips to the job site by the pump manufacturer's representative. All costs for these start-up services are included in the lump sum contract price.
11. A letter from manufacturer or factory trained service representative shall be provided certifying that the installation of each pump is satisfactory.

B. Training: For each chemical feed system, the following shall be provided:

1. Furnish the services of a factory representative for one (1) day during the installation phase of the equipment. The factory representative shall have full knowledge and experience in the installation of the type of equipment being installed.
2. Furnish the services of a factory representative for one (1) day who has complete knowledge of proper operation start-up procedure and maintenance requirements to inspect the final installation and supervise a test run of the equipment.
3. Furnish the services of a factory representative for one (1) day who has complete knowledge of the operational maintenance requirements of the

system. The factory representative shall instruct the City 's personnel in the proper operation and maintenance of the equipment and provide a comprehensive O&M manual.

END OF SECTION

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR SPRINKLER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.02 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.
4. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plasticor Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inchannular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inchannular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

    a. Piping Smaller Than NPS 6 Cast iron-pipe sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inchannular clear space between piping and sleeve for installing sleeve-seal system to make installation water tight.

4. Concrete Slabs above Grade:

    a. All Piping: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

5. Interior Partitions:

    a. All Piping: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

END OF SECTION

SECTION 21 05 18
ESCUTCHEONS FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Brass Craft Manufacturing

B. Dearborn Brass

C. Keeney Manufacturing Company

2.02 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.03 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
d. Insulated Piping: One-piece stainless steel with polished stainless-steel finish.
e. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
f. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
g. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
h. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
i. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.

j. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
k. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
l. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
m. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
n. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
o. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
p. Bare Piping in Unfinished Service Spaces: One-piece cast brass with polished, chrome-plated finish.
q. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
r. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
s. Bare Piping in Equipment Rooms: One-piece cast brass with polished, chrome-plated finish.
t. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.02 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE SUPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified MD professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design trapeze pipe hangers and equipment supports.

B. NFPA Compliance: Comply with NFPA 13.

C. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Stainless Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Type 316, ASTM A276

B. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

2.5 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.6 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with building code requirements for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 90 00 "Painting and Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.

3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Comply with NFPA requirements.

J. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

K. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 21 05 53
IDENTIFICATION FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch-thick, with predrilled holes for attachment hardware.

2. Letter Color: White
3. Background Color: Red.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABEL.

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.3 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain, beaded chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

    a. Wet-Pipe Sprinkler System: 2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 21 93 00
FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes pipe materials, fittings, valves, sprinkler heads, fire dept. connections.

1. Provide wet pipe automatic sprinkler systems in rooms as shown.

2. Provide sprinkler systems to be automatically fire responsive and installed to accommodate building structure and equipment.

3. Fire protection drawings are intended to show basic requirements. Quantity, size and location of sprinkler heads and size and location of branch feeder piping, is to be determined by the Contractor. Provide sprinkler heads where necessary to give adequate protection for concealed areas, spaces adjacent to beams, columns and ducts, and to other areas in protected spaces where sprinkler coverage may be fully or partially obstructed.

4. Provide fire protection systems complete in all respects complying with provisions of the National Fire Protection Association (NFPA) Standards, local codes and ordinances, requirements specified herein. Resolve conflicting requirements by meeting the more stringent requirement in each case.

5. Provide an angle or globe valve in properly sized main drain piped to acceptable drain location for use in system flow tests.

6. Provide all equipment and devices listed or approved for their intended service by Underwriters' Laboratory, Factory Mutual.

B. All conduit and wiring from alarm valves and devices and sprinkler devices (tamper switches, flow switches, pressure switches, etc.) to fire alarm panels shall be furnished and installed in Contract

1.02 RELATED SECTIONS

A. Specification 09 90 00 – Painting and Coating

B. Specification 21 05 29 – Hangers and Supports for Fire Suppression Piping

C. Specification 21 05 53 –Identification for Fire Suppression Piping

1.03 REFERENCES

A. ASME B16.3 - Malleable-Iron Threaded Fittings, Class 150 and 300

B. ASME B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250

C. ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent

D. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle

E. AWWA C510 - Double Check Valve Backflow Prevention Assembly

F. AWWA C511 - Reduced Pressure Principle Backflow Prevention Assembly

G. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

H. ASTM A 795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

I. NFPA 13 - Standard for the Installation of Sprinkler Systems

J. FM - Approval Guide

K. UL - Fire Protection Equipment Directory

L. AISI - American Iron and Steel Institute

1.04 SUBMITTALS

A. General: Provide submittals, including the following, in conformity with the General Conditions.

B. Shop Drawings: Submit complete layout of working drawings, indicating pipe materials used, fittings, supports, and floor and wall penetration seals. Indicate weights, mounting, and support details.

1. Provide manufacturers catalog data for piping, fittings, valves, sprinkler heads, fire department connections, flow detection and alarm devices, and gauges.

2. Delegated-Design Submittal: The Contractor shall have his working drawings and hydraulic calculations prepared, signed and sealed by a MD Professional Engineer. Submit for review working plans of the installation to the Engineer showing layout of all areas with automatic sprinkler protection, showing proposed location of sprinkler heads with respect to lights, diffusers, ceiling grid, framing members, etc. Data on these working plans shall include, but not be limited to the following: size of all piping; method of anchoring or hanging pipe lines; location and type of valves; position, type and temperature ratings of sprinkler heads, zone valves, stand pipes, and

detectors; material and equipment list indicating manufacturers' names and types; structural, mechanical, electrical and architectural coordinating information; hydraulic calculations and the various other items pertinent to the complete installation of the systems. After approval from the Engineer, working plans, hydraulic calculations, specifications, etc., shall also be submitted for approval to the local authorities for plan approval and permits.

3. Operations and Maintenance Manuals:

   a. Submit under provision of Division 1 - General Requirements

1.05 QUALITY ASSURANCE

A. Codes: Perform Work to meet following codes.

1. Sprinkler System - NFPA 13
2. Valves - Bear UL or FM Label or Marking

B. Permits: Contractor shall obtain and pay for all required permits, fees, inspections and approvals by authorities having jurisdiction.

C. Except as modified herein, conform to the required and advisory provisions of the International Building Code and NFPA 13 (whichever is the most stringent) for design, equipment materials, installation, workmanship, examination, inspection, and testing. Include all materials, accessories, and equipment inside and outside the building for each system to be complete and ready for use. Design and provide each system to accommodate blind spaces, piping, electrical equipment, ductwork, and other construction and equipment in accordance with detailed drawings submitted for approval. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and supply air diffusers. Provide devices and equipment for fire protection service of a make or type which is UL listed or FM approved for use in sprinkler systems.

D. The Contractor shall provide complete, new sprinkler fire protection water service connections complete with UL listed and FM approved reduced pressure principle backflow preventer assembly, alarm valve, water motor gong, fire department siamese connection, sprinkler heads, flow switches, piping, hangers, test connections and all appurtenances. It shall be understood that the final design of the sprinkler fire protection systems, including, but not limited to, the arrangement, hydraulic calculations, size and location of risers, feed mains, cross mains, test connections, branch lines and drains, and the location, spacing, number and types of heads or nozzles shall be the responsibility of the Contractor and shall conform with the requirements of the, local Authorities, Standards and Codes listed in these specifications. The Contractor shall be responsible for procuring approval from the local fire department and building department

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:

1. Deliver and store valves in shipping containers with labels in place.
2. Provide temporary protective coating on cast-iron and steel valves.
3. Provide end caps and closures on piping and fittings.

B. Acceptance: Accept equipment on-site in factory packaging and inspect for damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The following manufacturers are acceptable. Equivalent products of other manufacturers may be submitted for approval.

B. Gate Valves

1. Nibco F-607-0TS
2. Stockham
3. Kennedy Va., Division of ITT Grinnell Co., Inc.

C. Swing Check Valves

1. Nibco F-908-W
2. Stockham
3. Kennedy Va., Division of ITT Grinnell Co., Inc.

D. Riser Check Valves

1. Reliable Model G
2. Viking EasyPac Riser Manifold Assembly
3. Victaulic

E. Grooved Mechanical Couplings

1. Victaulic
2. Reliable Automatic Sprinkler Co., Inc.

F. Sprinkler Heads

1. Viking Corp.
2. Reliable Automatic Sprinkler Co., Inc.
3. Approved equal

G. Water Flow Switches

1. Notifier - Series WFD
2. Potter
3. System Sensor

H. Tamper Switches

1. Notifier - Series OSY2
2. Potter
3. System Sensor

I. Wall Siamese

1. Croker 6010 series
2. Potter-Roemer
3. Star

J. Pipe Couplings

1. Victaulic – Firelock
2. Or approved equa

2.02 PIPE AND FITTINGS

A. Comply with NFPA 13 for pipe and fittings.

1. Install fire protection piping in accordance with National Fire Protection Association Standards.
2. Provide seamless carbon steel pipe complying with ASTM A795 or A53.
3. Piping 2” and smaller shall be schedule 40 with screwed joints and fittings.
4. Piping 2 1/2” and larger shall be schedule 40 joined by roll groove type couplings.

B. Screwed Fittings:

1. Screwed fittings 2-inches and smaller shall be malleable iron flat band fittings, ASME B16.3, 125 pounds. Malleable iron shall conform to the requirements of ASTM A197.
2. All threads shall be clean cut and smooth conforming to the American Standard for Pipe Threads, ASME B1.1. Fittings shall be with right and/or left hand threads as required.
3. Unions and railroad unions and union elbows and tees shall be malleable iron fitted with brass to iron seats unless otherwise specified.

C. Groove type couplings and fittings:

1. Couplings shall be FM approved for fire protection
2. Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12.
3. Coupling gasket: Grade "E" EPDM type A Vic-plus gasket system.
4. Bolts/nuts: heat treated plated carbon steel, meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.
5. Fittings shall be ductile iron conforming to ASTM A-536, grade 65-45-12

D. Provide drip pans with suitable connections to the drainage system.

1. Drip Pans: Install polished, 16-ounce reinforced copper drip pans under all pipes that pass over or near electrical control equipment as shown.

2.03 VALVES

A. General: Provide gate, check, globe and angle valves UL listed and FM approved for fire protection service.

1. Valves open when their handwheel is turned counter clockwise.
2. Valves 2-inch size and smaller: Provide screwed pattern bronze construction valve with union bonnet and rising stem.
3. Valves 2-1/2 inches and larger: Provide valves of grooved pattern iron bodies with bronze trim, bolted bonnets, outside screw and yoke, and rising stem.
4. Provide valves of same type from same manufacturer.

B. Gate Valves: Provide gate valves in piping to isolate each major item of equipment and, in general, to isolate each floor and each major portion of system.

C. Check Valves: Provide check valves of the horizontal, single disc, swing type designed with full pipe diameter water passage. Provide check valves having bronze renewable seat ring, disc, and hinge bushing and pins.

D. Commercial Riser Assembly

1. Provide for wet pipe sprinkler system a riser assembly with trim package.
2. The riser assembly shall be factory tapped for 1-1/4" main drain and ½" plugged NPT system connection with additional ¼" supply connections.
3. Trim components shall consist of a 1-1/4" bronze angle valve main test and drain connection, and a 300-psi pressure gauge connection with bronze globe valve.

2.04 BACKFLOW PREVENTERS

A. Construct all moving parts and trim of corrosion resistant materials with neoprene valve discs.

B. Provide each backflow preventer assembly complete with OS&Y gate valves at both inlet and outlet sides.

C. Double check Detector assembly

1. Regulatory Compliance: AWWA C510, ASSE 1015, ICC (IPC).
2. Valve Body: 304 stainless steel.
3. End Connections: flanged.
4. Maximum Working Pressure: 175 psi (350 psi test).
5. Temperature Range: 32 degrees to 140 degrees F.
6. Watts Regulator Company; Model 709-DCDA, or approved equal

2.05 SPRINKLER HEADS

A. General: Provide upright or pendent type sprinklers as shown or specified. Use pendent type sprinklers in finished areas, with chrome or nickel plated finish.

B. Temperature Rating: Provide sprinklers for dry- and wet pipe systems having fusible element of standard temperature rating, unless otherwise specified or approved.

C. Deflectors: Provide sprinklers with suitable water deflectors giving uniform circular distribution pattern, unless otherwise required. Provide sprinklers of all types from common manufacturer.

D. Extra Heads: Provide wall mounted cabinet, housing minimum of six extra sprinkler heads and sprinkler wrench. Extra sprinkler heads shall include two of all types used.

2.06 SIAMESE CONNECTION

A. General: Provide and install one or more siamese connections where shown.

B. Type: Provide siamese of freestanding sidewalk type or of flush-mounted wall type, as shown.

C. Size: All siamese connections are 2 1/2" x 2 1/2" x 4", except as noted, with polished brass finish and branded with the legend "AUTOSPKR" or as appropriate. Furnish siamese connections with polished brass caps and chains.

D. Threads: Provide hose threads conforming to local fire department requirements.

E. Check Valves: Provide and install approved check valve and automatic ball drip valve at each siamese connection.

2.07 GAUGES

A. General: Provide Bourdon tube type pressure gauge with 4 l/2-inch minimum diameter case, suitable for 250 psig maximum pressure with markings in 5 psi increments.

2.08 WATER FLOW DIRECTION AND ALARM

A. Provide vane type water flow switch for each wet sprinkler system.

1. Provide flow switch on system side of control valve. Provide flow switches of dual SPDT switches/Form C contacts type with contacts rated for at least 10 amps on 115-volt, 60 hertz, single phase service. Provide flow switches having either electric or mechanical retarding device to prevent false alarms upon normally occurring supply pressure surges.
2. Alarm check valve incorporating integral flow alarm switch and retarding chamber are acceptable for flow detection provided its switch characteristics meet those stated for the vane-type switch specified above.

B. Water Flow Alarm: Each water flow switch, upon sensing water flow, initiates signal actuating l0 inch electric alarm bell, mounted outside building at approved location.

1. Provide weatherproof alarm bell with suitable guard and weatherproof back box. Keep unused flow detector contacts available for other specified alarm functions.

2.09 TAMPER SWITCHES

A. Description: Provide tamper switches with dual SPDT contacts at control valves and the DCDA gate valves. Locate switches so as not to interfere with normal valve operation. Provide tamper switch in weatherproof die-cast housing with conduit inlet and valve attachment. Provide switch mechanism 120-volt ac and entire installed assembly tamper resistant.

2.10 IDENTIFICATION SIGNS

A. Provide sprinkler system identification signs in accordance with the NFPA 13.

PART 3 – EXECUTION

3.01 PREPARATION

A. Remove scale and foreign material, from inside and outside piping before assembly.

3.02 INSTALLATION

A. General: Install equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Obtain Fire Department approvals of sprinkler system shop drawings and all local authorities having jurisdiction.
2. Provide riser check valve assembly at sprinkler system water source connection.
3. Locate fire department connection with sufficient clearance from walls, obstructions or adjacent siamese connections to allow full swing of fire department wrench handle.
4. Provide drains piped to and discharging into floor drains.
5. Install baffles between sprinkler heads spaced less than 6 feet apart.
6. Install valves to water source and test system. For all leaks replace any leaking sprinkler heads. Tighten or replace joint connector.

B. Hangers and Supports: Provide hangers and supports in accordance with NFPA Standard 13 and Specification 21 05 29.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to participate in the field testing of the equipment, as specified in Division 1.

B. Tests: After installation of the sprinkler system and all appurtenances.

1. Hydrostatically test sprinkler system without leakage at not less than 200 psig or 50 psig above maximum working pressure, whichever is higher, for two hours, and flushed in accordance with the provisions of NFPA Standards.
2. Have acceptance test include test of alarm equipment. Promptly correct any deficiencies.
3. Provide testing only at times scheduled in advance, and in the presence of the fire department authority.

END OF SECTION

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.02 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.
4. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plasticor Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inchannular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inchannular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

    a. Piping Smaller Than NPS 6 Cast iron-pipe sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inchannular clear space between piping and sleeve for installing sleeve-seal system to make installation water tight.

4. Concrete Slabs above Grade:

    a. All Piping: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

5. Interior Partitions:

    a. All Piping: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

END OF SECTION

SECTION 22 05 18
ESCUTCHEONS FOR PIPING

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type, with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
f. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19
METERS AND GAGES

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 BIMETALLIC-ACTUATED THERMOMETERS

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

1. Ernst Flow Industries.
2. Palmer Wahl Instrumentation Group.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.
5. WIKA Instrument Corporation - USA.

B. Standard: ASME B40.200.

C. Case: sealed type; stainless steel with 3-inchnominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.02 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

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

a. Tel-Tru Manufacturing Company.
b. Trerice, H. O. Co.
c. Weiss Instruments, Inc.
d. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inchnominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.03 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.04 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

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

    a. AMETEK, Inc.; U.S. Gauge.
    b. Palmer Wahl Instrumentation Group.
    c. Trerice, H. O. Co.
    d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

e. Weiss Instruments, Inc.
f. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inchnominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Match pressure connection size in first subparagraph below with gage attachment size.
6. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.
8. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi
9. Pointer: Dark-colored metal.
10. Window: Glass.
11. Ring: Metal.
12. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

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

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.
f. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inchnominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.

2.05 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

I. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

3.05 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg.

3.06 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Sealed, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be:

1. Sealed, direct-mounted, metal case.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Bronze gate valves.
4. Bronze globe valves.
5. Iron gate valves.

B. Related Sections:

1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 22 11 16 "Domestic Water Piping" for valves applicable only to this piping.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.05 QUALITY CONTROL

A. ASME Compliance:

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6and smaller, except for plug valves.

E. Valves in Insulated Piping: With 2-inchstem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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

a. American Valve, Inc.
b. Hammond Valve.

c. Legend Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

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

a. American Valve, Inc.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

2.03 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

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

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Red-White Valve Corporation.
    h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 200 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

2.04 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:

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

    a. American Valve, Inc.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron, bronze, or aluminum.

2.05 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

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

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Red-White Valve Corporation.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig.
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded or solder joint.
    e. Stem and Disc: Bronze.
    f. Packing: Asbestos free.
    g. Handwheel: Malleable iron, bronze, or aluminum.

2.06 IRON GATE VALVES

A. Iron Gate Valves, NRS, Class 125:

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

    a. American Valve, Inc
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

1. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig.
    c. Body Material: Gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Disc: Solid wedge.
    g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.02 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: gate valves.
2. Throttling Service: ball, butterfly or gate valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125 bronze disc.
3. Ball Valves: Two piece, full port, bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125, RS
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger: Iron gate valves, Class 125 with flanged ends.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections "General Conditions of the Construction Contract", "Special Conditions", and "Division 1 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections "General Conditions of the Construction Contract", "Special Conditions", and "Division 1 - General Requirements" form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a MD qualified professional engineer, using performance requirements and design criteria indicated.

1.05 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified MD professional engineer. Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by MD professional engineer responsible for their preparation.

1.06 QUALITY CONTROL

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing hangers and supports and providing professional engineering services needed to assume engineering responsibility.

    a. Engineering Responsibility for trapeze hangers: Preparation of working plans, calculations by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Stainless Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Type 316, ASTM A276

B. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psigminimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psigminimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inches thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 99 00 " Painting and Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
5. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
6. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
7. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.04 ACTION SUBMITTALS

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

1.05 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.04 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.05 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inchnumbers.

1. Tag Material: Brass, 0.032-inchminimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.06 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

8. Domestic Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

9. Sanitary Waste and Vent Piping:

   a. Background Color: Black.
   b. Letter Color: White.

10. Natural Gas Piping:

    a. Background Color: Yellow.
    b. Letter Color: Black.

3.04 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Cold Water: 1-1/2 inches, round.
    b. Hot Water: 1-1/2 inches, round

2. Valve-Tag Color:

    a. Cold Water: Green.
    b. Hot Water: Green.

3. Letter Color:

    a. Cold Water: White.
    b. Hot Water: White.

3.05 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 CITED STANDARDS

A. ASTM International:

1. ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

2. ASTM C547Standard Specification for Mineral Fiber Pipe Insulation

3. ASTM C552Standard Specification for Cellular Glass Thermal Insulation

4. ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

5. ASTM C920 Standard Specification for Elastomeric Joint Sealants

6. ASTM C921 Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

1.04 ACTION SUBMITTALS

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

B. Field quality-control reports.

1.05 QUALITY CONTROL

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.

b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mildry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 permsat 0.0625-inchdry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.04 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass : Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.06 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. ABI, Ideal Tape Division; 428 AWF ASJ.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    c. Compac Corporation; 104 and 105.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inchin width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inchin width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. ABI, Ideal Tape Division; 370 White PVC tape.
    b. Compac Corporation; 130.
    c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inchin width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.08 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inchthick, 1/2 inchwide with wing seal closed seal.

2.09 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

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

    a. Engineered Brass Company.
    b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    c. McGuire Manufacturing.
    d. Plumberex.
    e. Truebro; a brand of IPS Corporation.
    f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 incheso.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor

insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
2. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe

insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

3. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
4. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
7. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inchoverlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.010 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.011 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch thick.

B. Domestic Hot Water:

1. Insulation shall be following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1.5 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be following:

a. Flexible Elastomeric: 1/2 inch thick.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.04 ACTION SUBMITTALS

A. Drawings: Domestic water system drawn to scale including plans, elevations and details.

B. Product Data: For transition fittings and dielectric fittings.

1.05 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

D. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.03 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys, 95-5 tin-antimony.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.04 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.05 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

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

    a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    b. Central Plastics Company.
    c. Matco-Norca.
    d. Watts; a division of Watts Water Technologies, Inc.
    e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psigminimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric-Flange Insulating Kits:

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

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump

Q. Install thermostats in hot-water circulation piping.

R. Install thermometers on inlet and outlet piping from each water heater.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

V. JOINT CONSTRUCTION

W. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

X. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

Y. 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

Z. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

AA. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

BB. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.02 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Aboveground Domestic Water Piping NPS 2and Smaller: Plastic-to-metal transition fittings or unions.

3.03 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inchrod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.06 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.08 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.09 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppmof chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppmof chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Strainers.
6. Drain valves.
7. Water-hammer arresters.
8. Trap-seal primer systems.
9. Temperature-actuated, water mixing valves

B. Related Requirements:

1. Section 22 05 19 "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, non-removable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.04 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

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

    a. Watts LF909.
    b. Zurn Industries, LLC.
    c. Flomatic Corporation.
    d. Ames Co.

2. Standard: AWWA C511-92
3. Approvals: ASSE 1013, NSF, Lead Free
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 12 psig
6. Size: See Drawings
7. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved
8. End Connections: Threaded for NPS 2 and smaller
9. Configuration: Designed for horizontal, straight-through flow.
10. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet. Non-Rising gate valves
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double Check Valve Detector Assembly Backflow Preventers:

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

    a. Watts 709 DCDA.
    b. Zurn Industries, LLC.
    c. Ames Co.

2. Standard: AWWA C510
3. Approvals: UL, FM, ASSE 1048
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 10 psig
6. Size: See Drawings.
7. Body: cast iron with interior lining that complies with AWWA C550 or that is FDA approved
8. End Connections: Flanged
9. Configuration: Designed for horizontal, straight-through flow.
10. Valves: outside stem and yoke (OSY) resilient seated gate valves

2.05 BALANCING VALVES

A. Memory-Stop Balancing Valves:

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

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO Inc.

e. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psigminimum CWP.
4. Size: NPS 2or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.06 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

   a. Strainers: 0.020 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.07 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psigminimum CWP.
3. Size: NPS 3/4
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.08 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters HA:

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

    a. AMTROL, Inc.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products.
    g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.09 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device TP-1:

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

    a. Precision Plumbing Products, Inc.
    b. Sioux Chief Manufacturing Company, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS ½ threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS ½ threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device TP-2:

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

a. Precision Plumbing Products, Inc.
b. Sioux Chief Manufacturing Company, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1044, lavatory P-trap with NPS ½" minimum, trap makeup connection.
3. Material: Coper.

2.010 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves TMV:

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

a. Armstrong International, Inc.
b. Honeywell Water Controls.
c. Zurn Industries, LLC.
d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze or brass body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F

2.011 WALL HYDRANTS:

A. Non-Freeze Type

1. Cast-bronze 3/4-inch hose thread outlet,
2. Self-draining,
3. Integral vacuum breaker-backflow preventer,
4. Pressure relief valve,
5. T-handle
6. Polished face, bronze wall casing,
7. Bronze operating parts
8. 3/4-inch pipe thread inlet connection.

2.012 HOSE BIBBS:

A. Interior hose bibb

1. Hose thread outlet- 3/4-inch
2. Threaded female inlet flange, 3/4-inch
3. Spout outlet in-line vacuum breaker for back-siphonage protection, 3/4-inch

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to building. Comply with authorities having jurisdiction.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
2. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

D. Install water-hammer arresters in water piping according to PDI-WH 201.

E. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units surface mounted on wall as specified.

3.02 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.03 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 33 00
ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 STIPULATIONS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

A. The specifications sections “General Conditions of the Construction Contract”, “Special Conditions”, and “Division 1 - General Requirements” form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of electric, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY CONTROL

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. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Faulty operation of controls.
    b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

    a. Electric, Tankless, Domestic-Water Heaters: Five years.

PART 2 - PRODUCTS

2.01 ELECTRIC, DOMESTIC-WATER HEATER (TANK STYLE)

A. Electric, Domestic-Water Heater

1. Storage-Tank Construction: Steel.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

2. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE 90.2.
e. Jacket: Steel, cylindrical, with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Heating Elements: Two; electric, screw-in immersion type; wired for non-simultaneous operation unless otherwise indicated. Limited to 12 kW total.
h. Temperature Control: Adjustable thermostat.
i. Safety Control: High-temperature-limit cutoff device or system.
j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 100 psig.
b. Capacity Acceptable: 4 gal.
c. Air Precharge Pressure: as required.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

C. Heat-Trap Fittings: ASHRAE 90.2.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on concrete pad.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the electric, domestic-water heaters.

END OF SECTION

SECTION 22 42 18
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Society of Mechanical Engineers (ASME).
2. American Society of Sanitary Engineering (ASSE): 1010, Performance Requirements for Water Hammer Arresters.
3. Plumbing and Drainage Institute (PDI):

    a. Code Guide 302 and Glossary of Industry Terms.
    b. WH-201, Water Hammer Arrester Standard.

4. Underwriters Laboratories Inc. (UL).

1.02 SUBMITTALS

A. Make submittals to the Engineer in accordance with Division 1 specifications.

B. Action Submittals: Catalog information and rough-in dimensions for plumbing fixtures, products, and specialties.

1.03 REGULATORY REQUIREMENTS

A. Comply with local and state requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Emergency Showers and Eyewashes:

1. Haws.
2. Western.
3. Guardian.

B. Plumbing Specialties:

1. Shock Arresters:

    a. Smith.
    b. Sioux Chief.

c. Precision Plumbing Products.

2. Pressure/Temperature Relief Valves:

a. Cash-Acme.
b. Kunkle Valve.
c. Watts.

3. Pressure Gauges:

a. Ashcroft.
b. Marsh.
c. Marshalltown.

4. Thermometers:

a. Trerice.
b. Weksler.

2.02 GENERAL

A. Fixture Trim: Provide plumbing fixture trim where applicable on fixtures.

B. Plumbing Fixtures: Indicated by fixture as shown on Drawings.

C. Plumbing Specialties: where applicable or as shown on Drawings.

D. Exposed fixture connections and piping shall be polished chrome-plated.

2.03 MATERIALS

A. Safety Equipment:

1. Safety Shower/Eyewash Combination (All Stainless Steel):

a. Model: Haws Drinking Faucet Co.; Model 8330.
b. Shower: Stainless steel deluge.
c. Eyewash: Stainless steel aerated eye/face wash and stainless steel bowl.
d. Valve: Stay open.
e. Support: Freestanding, 1-1/4-inch stainless steel pipe standard, stanchion, and floor flange.
f. Alarms: Magnetically operated proximity switches and remote-mounted strobe light.

B. Plumbing Specialties:

1. Water Hammer Arresters:

a. Materials: ASSE 1010 certified, Type L copper tube, HHPP piston with two lubricated EPDM O-rings, FDA approved lubricant, rolled piston stop, wrought copper male thread adapter.
b. Manufacturer and Product: Sioux Chief Mfg. Co., Inc.; Series 650 and 660.

2. Pressure/Temperature Relief Valve:

a. Materials: ASME/AGA rated, bronze body construction, vacuum relief valve vent in drain, backup emergency safety fuse plug, tamper-resistant bonnet screws, test lever, short thermostat, and automatic reseating.
b. Manufacturer and Product: Watts Industries, Inc.; Series 40.

3. Pressure Gauge:

a. Materials: 3-1/2-inch gauge size, 0 to 160 psi range, steel case, glass crystal, brass movement, and 1/3-inch NPT lower connection.
b. Manufacturer and Product: Ashcroft Dresser Instrument Division, Dresser Industries, Inc.; Type 1008.

4. Thermometer:

a. Materials: Adjustable angle, red reading mercury type with 9-inch case and 30 degrees F to 180 degrees F range, 3-1/2-inch aluminum stem, and separate NPT brass thermowell.
b. Manufacturer and Product: H.O. Trerice Co.; Model A005.

PART 3 - EXECUTION

3.01 PREPARATION

A. Drawings do not attempt to show exact details of fixtures. Changes in locations of fixtures, advisable in opinion of Contractor, shall be submitted to Engineer for review before proceeding with the Work.

3.02 INSTALLATION

A. Safety Equipment:

1. System Shutoff Valves:

a. Shutoff valves shall give visual indication of position (open or closed).
b. Shutoff valves shall be lockable valves and locked in open position.

2. Each safety shower, eyewash, combination safety shower/eyewash shall have red safety signoff tag. After completing requirements listed below, Contractor and Commission shall sign red safety signoff tag. Requirements are as follows:

    a. Visually check safety shower/eyewash piping for leaks.
    b. Verify that upon operation, stay-open valves remain open.
    c. Showerheads to be between 82 inches and 96 inches above standing surface.
    d. Shower spray pattern, when valve is full open, shall be a minimum 20 inches in diameter at 60 inches above standing surface.
    e. Water arcs from eyewash spray heads must cross. Test with eyewash gauge; Haws Drinking Faucet Co., Model 9015.
    f. Minimum flow rates for safety showers shall be 20 gpm.
    g. Minimum flow rates for eyewashes shall be 3 gpm.
    h. Tempered water shall be temperature indicated on Drawings.

B. Plumbing Specialties:

1. Shock Arresters:

    a. Install PDI-certified and rated shock arresters, sized and located in accordance with PDI WH-201 and as shown on Drawings.
    b. Install adjacent to equipment wherein quick closing valves are installed.
    c. Install at each emergency safety shower.
    d. Shock arresters to have access panels or to be otherwise accessible.

2. Thermometers and Pressure Gauges:

    a. Arrange devices to facilitate use and observation.
    b. Install in orientation that will allow clear observation from ground level.
    c. Provide pressure gauges with block valves.
    d. Install thermometers in thermowells.

C. Caulk penetrations of exterior walls with weatherproof sealant.

D. Adjust water flows in domestic water systems for reasonable water flows at each plumbing fixture, terminal device, and recirculation loop. Flush valve fixtures shall be adjusted for proper flush cycle time and water quantity.

3.03 FIELD QUALITY CONTROL

A. Notify Commission and Engineer 48 hours prior to shower testing. Commission and Engineer reserve the right to witness all tempered water and safety shower testing.

B. Test safety shower and eyewash units. Water flow must be tested at both showerhead and eyewash/face ring.

1. Shower Flow:

    a. Test with tube-type water gauge (Haws Drinking Faucet Co., Model 9010) and 5-gallon container.
    b. Container shall fill in 10 seconds or less, with a minimum 20-gpm flow.

2. Eyewash Flow:

    a. Test with tube-type water gauge (Haws Drinking Faucet Co., Model 9010) and 1-gallon container.
    b. Container shall fill in 20 seconds or less.

3. Contractor shall log, date, and initial inspection upon passing flow tests.

C. Verify alarm operation both locally and systemwide. Notify security prior to test if alarm is connected systemwide.

END OF SECTION

SECTION 23 05 00
VIBRATION AND WIND CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. Contractor shall provide all professional services, labor, materials, tools, equipment, and incidentals as shown, specified, and required to design, furnish, and install vibration control and wind control for process mechanical, HVAC, plumbing, fire protection, electrical, instrumentation and control, and architectural components.

2. Extent of components requiring controls are described in this section and as required by laws and regulations. The work includes:

    a. Vibration Controls for Components.

    b. Wind Controls for Components.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the vibration and wind controls Work.

C. Related Sections:

1. Section 09 90 00, Painting.

2. Section 23 34 00, Fans

3. Section 23 73 80, Packaged AC units

1.02 REFERENCES

A. Standards referenced in this Section are:

1. AWS D1.1, Structural Welding Code – Steel.

2. AWS D1.2, Structural Welding Code – Aluminum.

3. AWS D1.3, Structural Welding Code – Sheet Steel.

4. AWS D1.6, Structural Welding Code – Stainless Steel.

5. CISCA 0-2, Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings.

6. CISCA 3-4, Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings.

7. National Roofing Contractors Association (NRCA) Standards.

1.03 DEFINITIONS

A. The following definitions are used in this Section:

1. Components: Process Mechanical, HVAC, plumbing, fire protection, electrical, instrumentation and control, architectural, and other non-structural equipment, systems, and elements permanently attached to structures, including supporting structures and attachments.
2. Component Assembly: Component assembled by Contractor from individual components of different Suppliers.
3. Controls: Vibration Control and Wind Control.
4. Controls Design Engineer: Professional Engineer responsible for Vibration Control and Wind Control.
5. Essential Facility: Buildings and other structures intended to remain operational in event of extreme environmental loading from flood, wind, snow, or earthquakes.
6. Failure: Separation of an attachment between Components, or Components and structure, vertical permanent deformation greater than 1/8-inch, horizontal permanent deformation greater than 1/4-inch, or failure of the equipment to perform its function.
7. Hazardous Contents: Material that is highly toxic or potentially explosive in sufficient quantity to pose significant life-safety threat to personnel working in building or the general public if an uncontrolled release were to occur.
8. Isolated Component: Component indirectly connected to structure through Control designed to prevent transmission of Component vibration to structure.
9. Lateral Forces: Horizontally applied forces resulting from wind.
10. Life Safety Systems: All systems involved with fire protection including sprinkler piping, water service piping, jockey pumps, fire pumps, fire dampers, smoke dampers, smoke exhaust systems, control panels and fire alarm panels associated with fire protection Components, and Components in Essential Facilities necessary for keeping the Essential Facility Operational.
11. Non-Isolated Component: Component that is connected to structure in such a way that allows transmission of Component vibration to structure.
12. Operational: Capable of providing intended function.
13. Process Mechanical: All mechanical Components that are not part of HVAC, plumbing and fire protection Components.
14. Vibration Control: Vibration isolating systems.
15. Wind Control: Wind restraining systems.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Supplier:

   a. Minimum of five years of experience producing Controls substantially similar to those specified in the Contract Documents and able to provide evidence of at least five installations in satisfactory operation for at least five years in the United States.

   b. Design and analysis delegated through Supplier shall be performed by a registered Professional Engineer licensed in same state as the Site.

2. Controls Design Engineer:

   a. Engage registered Professional Engineer licensed in same state as the Site, who has a minimum of five years of experience in providing engineering services for Vibration and Wind Controls.

   b. Submit qualifications data and include professional liability insurance certificate in amount of at least $1,000,000 per claim/aggregate with maximum deductible of $100,000.

   c. Responsibilities include:

      1) Reviewing performance and design criteria for Controls specified in the Contract Documents.

      2) Determining sizes and locations of Controls.

      3) Preparing or supervising preparation of design calculations and related drawings, Shop Drawings and submittals, testing plan development, test result interpretation, and comprehensive engineering analysis verifying compliance of Controls with the Contract Documents.

      4) Signing and sealing all calculations, design drawings, and Shop Drawings.

      5) Certifying that:

         a) Design of Controls was performed in accordance with performance and design criteria stated in the Contract Documents.

         b) Design conforms to Laws and Regulations, and to prevailing standards of practice.

      6) Provide installation instructions and drawings.

      7) Provide field quality control in accordance with Paragraph 3.3 of this Section.

3. Installer:

a. Engage an experienced installer to perform the Work of this Section who specializes in installing Controls similar to that required for this Project.

b. Submit name and qualifications to Engineer with the following information on a minimum of three completed, successful projects:

1) Names and telephone numbers of Citys, and Architects or Engineers responsible for project.

2) Approximate cost of Control Work for which installer was responsible.

4. Welder:

a. Qualify welding processes and welding operators in accordance with AWS D1.1, D1.2, D1.3, and D1.6 as appropriate for material to be welded.

b. Provide certification that welders employed on or to be employed for the Work have satisfactorily passed AWS qualification tests within previous 12 months. Ensure that all certifications are current.

1.05 SUBMITTALS

A. Informational Submittals: Submit the following:

1. Shop Drawings:

a. Detailed schedules of flexible and rigidly mounted Components to receive Controls. Schedules shall be numbered and include Contract Drawing number references where Component is located.

b. Specific details of Controls and anchorages, including number, size, and locations for each Component.

c. Details of attachment methods where walls, floors, slabs, or supplementary steel work are used for restraint attachment.

d. Location of all attachment and support points and forces transferred to supporting structure at each location, as a result of each load combination of static forces and Lateral Forces.

e. Detailed piping, ductwork, and conduit restraining system layout drawings showing their attachment to building or structure. Include dimensions, size, and location of restraints and attachment connections. Coordinate with system layout shop drawings provided under other sections, as applicable.

2. Product Data:

a. Supplier and model of Controls.

b. Supplier's literature, performance data, weight, illustrations, specifications, identification of materials of construction, dimensions of individual parts, and finishes.

c. Setting drawings, templates, and directions for installation of anchor bolts and other anchorages.

3. Certifications:

a. Provide completed Professional Design Services Performance Certification on Attachment A to this Section.

b. Controls Design Engineer's professional liability insurance certificate per Paragraph 1.4.A.2.b of this Section.

4. Delegated Design Submittals:

a. Information required to clearly demonstrate basis of design for Controls, including calculations, design dimensions, approach and assumptions, and Laws and Regulations on which design of Controls and anchorage is based. Design documents prepared by Controls Design Engineer shall bear the seal and original signature and date of the Controls Design Engineer. State of Engineer's registration, name, and license number shall be clearly legible on the seal.

5. Supplier's Instructions:

a. Instructions for shipping, storage protection, handling, and installation.

b. Routine maintenance requirements prior to start up.

6. Field Quality Control Submittals:

a. Supplier's Field Reports: Submit reports confirming that Controls have been installed in accordance with Supplier's recommendations and approved Shop Drawings and submittals.

b. Controls Design Engineer Report: Submit report confirming that Controls have been installed in accordance with the Controls design. Report shall bear the professional engineering seal, date, and original signature of the Controls Design Engineer.

7. Qualifications Statements: Submit qualifications for:

a. Supplier.

b. Controls Design Engineer.

c. Installer.

d. Welder.

B. Closeout Submittals:

1. Operation and Maintenance Data:

a. Submit complete operation, and maintenance manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.

b. Conform to Division 1, Operation and Maintenance Data.

PART 2 – PRODUCTS

2.01 SYSTEM PERFORMANCE

A. System Description:

1. Schedules in Part 3 of this Section describe Components that are to receive Vibration Control.

2. Tables in Part 3 and performance criteria specified in Paragraph 2.1.C of this Section describes Controls to be provided on Components and systems described in the schedules. Tables are general in nature and may include certain Components that may not be specified in the schedules to receive Controls, while the schedules are Project-specific.

3. Where components are subject to wind, design component and related anchorage to supporting structure to resist wind loads per applicable building, see structural drawings for wind speed. Using guy wires is allowed for assisting in support of components.

4. Design of Components, including Vibration Controls provided by Component Supplier if required, and associated anchorage to supporting structure, are delegated through Supplier. Design shall resist wind forces according to requirements of Laws and Regulations using wind load of 125 MPH ultimate wind speed.

5. Interconnection design of Component Assemblies, including Vibration Controls if required, and anchorage to supporting structure, shall be by Controls Design Engineer. Design of individual Components within assembly to resist wind forces is responsibility of individual Component Supplier. Component Assembly design shall resist wind forces according to requirements of Laws and Regulations, see structural dwgs for wind speeds. Coordinate design with each Supplier of Components used in the assembly and obtain approval of each Supplier prior to providing Shop Drawings for Component Assembly.

6. Equivalency: Products or methods specified for Controls are not intended to limit use of other products or methods of equivalent or superior quality and effectiveness.

B. Design Criteria:

1. Determine wind design loads of 125 MPH ultimate wind speed. See structural dwgs.
2. Analyses for anchorage shall include calculated dead loads, Lateral Forces, and capacity of materials utilized for connections to Components and structure. Analysis for anchorage shall include anchoring methods, bolt diameter, embedment, and weld requirements.
3. Design Wind Controls to accept, without failure, wind forces acting on Component's exposed wind surface area. Analyses for wind forces shall consider Lateral Forces applied on a minimum of two orthogonal axes in two directions per axis. Overturning moments may result in uplift forces that exceed gravitational forces at ground level that shall be incorporated into analysis.

C. Performance Criteria:

1. Curb or roof rail-mounted Components shall be attached to the curb or rails that shall, in turn, be attached to supporting structure, creating continuous load path for vertical and Lateral Forces. Sheet metal screw attachment is unacceptable.
2. Where location and characteristics of elements of supporting structure are not appropriate for supporting Component and transferring vertical and Lateral Forces, notify Engineer in writing.
3. Where changes in specified Components or location of Components are proposed by Contractor for convenience of Contractor and accepted by Engineer, modifications to supporting structure required by such changes shall be responsibility of Contractor at no additional cost to City. Design of modification shall consider all vertical and Lateral Forces and be signed, dated, and sealed by Controls Design Engineer.

2.02 MANUFACTURERS

A. Provide products of one of the following:

1. Vibration Mountings and Controls, Inc.
2. Mason Industries.
3. Kinetics Noise Control.
4. Amber/Booth Company, Inc.
5. Or equal.

2.03 VIBRATION ISOLATION TYPES

A. Type E: Combination Spring/Elastomer Hanger Isolator

1. Spring and neoprene elements in a steel retainer box with the features as specified in this Section for Type C and Type D isolators.

2. Hanger locations requiring pre-compression for holding piping at fixed elevation shall be pre-compressed by manufacturer.

3. Thirty-degree angularity feature is not required.

4. Product and Manufacturer: Provide one of the following:

   a. RSH, manufactured by Vibration Mountings and Controls.

   b. DNHS, manufactured by Mason Industries.

   c. Or equal.

2.04 MATERIALS OF CONSTRUCTION AND FINISHES

A. Miscellaneous steel angles, supports, and appurtenances shall be cleaned and prime-coated in the shop and field-painted.

B. Hardware in corrosive areas shall be Type 316 stainless steel. Hardware in non-corrosive areas shall be galvanized steel.

C. Neoprene and elastomer parts shall be resistant to ultraviolet radiation and constructed from high grade materials suitable for exposure to high concentrations of hydrogen sulfides, mercaptans, chlorine, and moisture in air.

2.05 IDENTIFICATION

A. Provide each Control device with Type 316 stainless steel tag embossed or engraved with serial number cross-referenced to Component schedule, in accordance with Section 10 14 23, Panel Signage.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which Control Work is to be performed and notify Engineer in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

B. Coordinate anchorage of Components to receive Controls with installation locations. Examine roughing-in of reinforcing and cast-in-place anchor bolts to verify locations before installation.

3.02 COMPONENT INSTALLATION

A. Install Controls in accordance with Supplier’s written instructions and Shop Drawings and submittals accepted by Engineer.

B. Rigid connections between Components and building structure shall not be made in a manner that degrades performance of Control systems.

C. Do not rigidly connect Isolated Components to building structure.

D. Bracing may occur from flanges of structural beams, upper truss chords in bar joist construction, and concrete inserts or cast-in-place anchor bolts. Component support shall not overstress the structure.

E. Install cable restraints with minimum slack to avoid short-circuiting associated Component.

F. Install cable assemblies without slack on Non-Isolated systems. Solid braces may be used in place of cables on rigidly attached systems except where single arm braces incorporate resilient bushings.

G. At locations where restraints or solid braces are located, brace support rods as required to accept compressive loads.

H. Minimum operating clearance under all Isolated Component bases shall be two inches.

3.03 FIELD QUALITY CONTROL

A. Controls Design Engineer Services:

1. Controls design engineer shall check controls installation before controls and related equipment are placed into operation.
2. Controls design engineer shall make at least one visit to the site.
3. After controls installation is complete, controls design engineer shall inspect completed controls work and certify in writing to contractor that all systems are installed in accordance with design. Contractor shall submit control design engineer's report to engineer, certifying correctness of the work.

B. Supplier's Services:

1. Supplier shall check Controls installation before Controls and related equipment are placed into operation.
2. Supplier shall make at least one visit to the Site.
3. After installation of Controls is complete, Supplier shall inspect completed Controls Work and certify in writing to Contractor that Controls are installed in accordance with Supplier's recommendations and Shop Drawings and submittals accepted by Engineer. Contractor shall submit Supplier's report to Engineer certifying correctness of the Work.

3.04 ADJUSTING

A. After entire system is started and under full operating load, adjust Controls so that Controls operate as designed.

3.05 CLEANING

A. Remove debris from beneath Components and in and around the vibration isolator.

3.06 SUPPLEMENTS

A. Supplements listed below, following the "End of Section" designation, are a part of this Section:

1. Controls Schedules:

   a. Schedule of HVAC Components for Vibration Control.

   b. Schedule of HVAC Components for Wind Control.

2. Controls Tables:

   a. Table 230500-A - HVAC System Components.

   b. Table 230500-B – Not Used.

   c. Table 230500-C – Not Used.

   d. Table 230500-D – Not Used.

   e. Table 230500-E – Not Used.

   f. Table 230500-F - Minimum Deflection Guide.

3. Attachment 230500-A – Professional Design Services Performance Certification.

END OF SECTION

CONTROLS SCHEDULES FOR SECTION 230500

Section 230500 Schedule of HVAC Components for Vibration Control		
Item No.	Component	Notes
1	Unit heaters	
2	Inline Fan	

NOTES:

Section 230500 Schedule of HVAC Components for Wind Control		
Item No.	Component	Notes
1	Exhaust fan	
2	Outdoor air conditioning unit	
3		

NOTES:

SECTION 23 05 00 TABLES

Abbreviations for Tables 230500-A, 230500-B, 230500-C, and 230500-D:

ISOL	Vibration Isolator
DEFL	Deflection
MTNG	Mounting
MDG	Minimum Deflection Guide – Table 230500-F

General Notes (G) for Tables 230500-A, 230500-B, 230500-C, and 230500-D:

Note G1: For variable speed Components with an operating speed below 600 rpm, select isolation deflection from Table 230500-F, Minimum Deflection Guide.

Note G2: Determine static deflection based on Table 230500-F, Minimum Deflection Guide.

Note G3: Deflections indicated are minimum at actual load and shall be selected for Supplier's nominal 5-, 4-, 3-, 2- and 1-inch deflection spring series; rpm is defined as lowest operating speed of Component.

Note G4: Single stroke compressors may require inertia bases with thickness greater than 14-inch maximum specified for Base B-2. Inertia base mass shall be sufficient to maintain double amplitude for 1/8-inch.

Note G4: For floor-mounted fans, substitute base Type B-2 for Class 2 or 3 and fan having static pressure over five inches of water column.

Note G5: Indoor utility sets with wheel diameters less than 24 inches need not have deflections greater than 0.75 inches.

Note G6: For Components with multiple motors, horsepower classification applies to largest single motor.

Reference Notes (R) for Tables 230500-A, 230500-B, 230500-C, and 230500-D:

Note R1: For roof applications, use base Type B-5.

Note R2: Curb Type B-3 shall use sound barrier RPFMA when there is no concrete underneath rooftop units. Curbs can be used for return plenums. (See Option No. 1 under Type B-3 base in Paragraph 2.5 of this Section.)

Note R3: Where curbs require supply and return sound attenuation package, use Type SRRFMA. (See Option No. 2 under Type B-3 base in Paragraph 2.5 of this Section.)

Note R4: Units may not be capable of point support. Refer to separate Specification Section for Component. If base is not specified in that

Section and external isolation is required, provide Type B-1 base under this Section for entire unit.

Note R5: Use Type B-6 where Non-Isolated support is required.

Note R6: Use Type B-4 where Non-Isolated curbs are used.

TABLE 230500-A - HVAC SYSTEM COMPONENTS										
			Mounted on Soil Supported Slab				Mounted on Suspended Slab and Floor or Roof System			
COMPONENT	HP, CLASS, OR SIZE	MTNG	ISOL	DEFL (in.)	BASE	RESTR	ISOL	DEFL (in.)	BASE	RESTR
Inline Fans		Clg	-	-	---	V	E	See MDG	---	V
Unit/Cab Heaters		Clg	D	0.30	---	V	D	0.30	---	V

Table 230500-F – MINIMUM DEFLECTION GUIDE	
rpm	MINIMUM REQUIRED DEFLECTION (inches)
Less than 400	3.5
401 to 600	2.5
601 to 900	1.5
Over 900	0.75

ATTACHMENT 230500-A

Professional Design Services Performance Certification

My name is _____.

My [State of Project Location] professional engineering/architecture license number is _____.

My license expires _____, 20_____.

The Project for which I have performed professional design services is described as_____.

The Specification Section(s) under which I have performed my services is/are _____.

The name and address of the individual or entity for whom I have performed professional design services is:

_____

_____

_____

I hereby certify that, to the best of my knowledge, information, and belief, I have performed or supervised performance of the professional design services hereunder, and that said services have been performed in accordance with Laws and Regulations and in accordance with the standard of care currently expected of professional engineers/architects performing similar services for Projects of similar size and complexity in [State of Project Location].

_____ _____

Date Signature

_____

Type or Print Name

_____

Name of Firm

_____

Street Address

_____

City/State/Zip Code

[PROFESSIONAL SEAL]

Telephone: _____ Fax: _____

END OF SECTION 230500

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish, install, connect, test, and place into satisfactory operating condition all valves as indicated on the Contract Drawings and as specified herein.

1. 02 RELATED SPECIFICATIONS

A. Specification 03 30 00 – Cast-in-Place Concrete.

B. Specification 09 90 00 – Painting and Coating.

C. Specification 23 05 53 – Identification for HVAC Piping and Equipment.

D. Specification 23 20 02 – HVAC Pipe and Pipe Fittings.

E. Specification 23 07 19 – HVAC Piping Insulation.

1.03 REFERENCES

A. Products and construction shall be in accordance with the following standards and specifications unless otherwise noted in this document. In case of conflict, the standard with more stringent requirements shall apply.

1. American National Standard Institute (ANSI).
2. American Society of Mechanical Engineers (ASME).
3. American Society of Testing and Material (ASTM).
4. American Water Works Association (AWWA).
5. American Welding Society (AWS).

1.04 SUBMITTALS

A. General:

In accordance with the procedures and requirements set forth in the General Conditions and Division 01, the Contractor shall obtain from the valve manufacturer and submit the following data:

1. Shop Drawings.
2. Operation and Maintenance Manuals.
3. Spare Parts Lists.

4. Special Tool List.
5. Certified Shop Tests.
6. Certified Letters of Compliance.
7. Maintenance and Lubrication Schedule.

Each submittal shall be identified where applicable by the Equipment Identification Number listed in the schedules or Specification Section and Paragraph Number.

B. Shop Drawings:

Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed valve's compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the Contractor disapproved without review.

Data to be submitted shall include but not be limited to:

1. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various parts and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.
2. Complete assembly, and installation drawings with clearly marked dimensions. This information shall be in sufficient detail to serve as a guide for assembly and disassembly and for ordering parts.
3. Assembled weight.
4. Design calculations.
5. Listing of all lubricants required for the equipment with a minimum of four equivalent and compatible natural and/or synthetic lubricants produced by different manufacturers. The listing shall include the estimated quality of lubricant required for one year of operation.
6. Sample data sheet of equipment nameplate(s) including information contained thereon.
7. Spare parts list.
8. Special tools list.

C. Operation and Maintenance Manuals:

1. The Contractor shall submit operation and maintenance manuals in accordance the procedures and requirements set forth in the General Conditions and Division 1.
2. Individual O&M manuals shall be required for cylinder activated valves. For all other valves, the O&M information shall be grouped into two manuals, one for all valves 3 inches in size and larger, and one for all valves less than 3 inches in size.

D. Certified Tests Results:

1. Contractor shall obtain from the manufacturer and submit to the Engineer copies of the results of all certified shop tests.

E. Certified Letters of Compliance:

1. The Contractor shall obtain from the manufacturer and submit to the Engineer copies of certified letters of compliance in accordance with the General Conditions and Division 01.

F. Comprehensive Lubrication Survey:

1. The Contractor shall submit a comprehensive lubrication survey in accordance with the General Conditions and Division 01.

1.05 QUALITY ASSURANCE AND QUALIFICATIONS

A. General:

1. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

PART 2 - PRODUCTS

2.01 VALVES

A. General:

1. The valves and accessories shall be in the quantity, quality, types, and sizes as indicated on the Contract Drawings and specified herein.
2. Construction:

a. All valves shall have a minimum design pressure rating of 150 psi and capable of a test pressure of 300 psi. Valves above grade shall have flanged or threaded ends. Buried service valves shall have mechanical joint pipe ends.

B. Specialties:

1. All valves shall have applied to them the same coatings as the adjacent piping.

C. Raised Face Flanges:

1. All raised face flanges in conformance with ANSI B16.5 Class 150 shall milled flat.

D. Special Tools:

1. The Contractor shall furnish 10 sets of special tools listed on the comprehensive list in accordance with the General Conditions and Division 01.

2.02 BALANCING VALVES 12 INCHES AND SMALLER

A. Valves shall be constructed for 175 lbs. working pressure at 250 degrees F, with threaded or flanged ends. All valves up to 3 inch pipe size to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings. Valves 4 inches and larger shall be fitted with bronze seat, replaceable bronze disc with EPOM seal insert and stainless steel stem. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with the internal EPT inserts and check valves. Valve bodies to have 1/4 inch NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated name plates to assure specific valve settings. Valves to be leak tight at full rated working pressure. All valves to be provided with molded insulation to permit access for balance and read-out. Valves shall be Bell & Gossett Model CB or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation:

1. The procedures regarding unloading, inspection, storage, and where applicable, installation, described in the Appendix of AWWA C500 entitled "Installation, Operation, and Maintenance of Gate Valves" shall be used for all valves.
2. All valves shall be manually opened and closed before installation to check their operation, and the interior of the valves shall be cleaned. Valves shall be placed in the positions shown on the Contract Drawings. Joints shall be made as directed under the piping specifications.
3. Position valve operators as shown on the Contract Drawings. When the position is not shown, install the valve so that it can be conveniently operated. Do not place operators at angles other than parallel to the floors or walls.
4. For normally closed non-lubricated plug valves, install the valve with the seat on the upstream side. In this orientation, the valve body will not be packed with the process liquid.

B. Valve Supports:

1. Valves shall be supported as integral components of the piping systems as specified in the Pipe Support Systems paragraph in Specification 23 20 02 – HVAC Pipe and Pipe Fittings.
2. All horizontally or vertically mounted valve operators, manual, pneumatic or electric, shall be designed to sustain the working torque without an external support.
3. Valve supports shall anchor the valves against an unbalanced force in either direction. The magnitude of the force shall be based on a pressure equal to twice the maximum working pressure with a maximum allowable stress of 1/2 of the support's yield strength.

C. Pipeline Flushing:

1. Shall be performed in accordance with the procedures specified in the Specification 23 20 02 – HVAC Pipe and Pipe Fittings.

D. Special Provisions:

1. Disinfection
2. Shall be performed in accordance with the procedures specified in the Specification 23 20 02 – HVAC Pipe and Pipe Fittings.

E. Testing:

1. All valves shall be hydrostatically field tested at the pipeline test pressures specified in the piping sections. Any leakage or "sweating" of joints shall be stopped and all joints shall be tight. All motor operated and cylinder operated valves shall be tested for control operation as directed by the Engineer. All valves shall be operated at the specified operating pressures contained in the valve schedule.

F. Painting and Coatings:

1. Valves shall be shop primed for interior and exposed piping service in accordance with Specification 09 90 0 – Painting and Coating.
2. Field painting shall be performed under this contract.

3.02 IDENTIFICATION

A. Each unit of equipment shall be identified with the equipment item numbers given on the Contract Drawings and in Division 1. A corrosion resistant tag or nameplate securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer=s name or trademark, size, service, operator type, valve

position, valve type, function and such other information as the manufacturer may consider necessary, or as specified, to complete identification. The Contractor shall furnish the valve schedule to the Engineer for approval.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all components of the system for identification of piping and equipment. The system includes the placing of identification signs and direction-of-flow arrows on all visible plant piping, the placing of nameplates on plant equipment and structures, and painting in color of all equipment and pipe, except stainless steel or aluminum surfaces, as shown on the Contractor's working drawings submitted under the related Specifications sections for equipment, piping and valves, and as required for a complete job.

1.02 RELATED SPECIFICATION

A. Specification 09 90 00 – Painting and Coating

1.03 PAYMENT

A. No direct payment will be made for these signs, flow charts or appurtenances; the cost must be included in the price bid for the piping system as specified in the Specifications.

1.04 REFERENCES

A.	ASTM D523	-	Standard Test Method for Specular Gloss
B.	ASTM D543	-	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
C.	ASTM D638	-	Standard Test Method for Tensile Properties of Plastics
D.	ASTM D646	-	Standard Test Method for Grammage of Paper and Paperboard (Mass per Unit Area)
E.	ASTM D709	-	Standard Specification for Laminated Thermosetting Materials
F.	ASTM D790	-	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
G.	ASTM D792	-	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
H.	ASTM D5420	-	Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

1.05 MANUFACTURER'S GUARANTEE

A. Provide the specified items from firms regularly engaged in the manufacture of identification devices of types and sizes required, with at least five (5) years' experience in manufacturing signs. In addition, the manufacturer shall guarantee the sign, in writing, against color fading, chipping, corroding or any other manufacturing defects for a period of ten (10) years.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Construct fiberglass reinforced plastic identification signs and nameplates of 70 mils thick fiberglass reinforced plastic conforming to ASTM D709.

B. Provide fiberglass reinforced plastic process with a blemish free, low gloss surface of superior permanence and durability in the colors selected. Provide each identification sign and nameplate in two colors and with the legend specified. Provide the backside of the sign in black or some other uniform color.

C. Provide lettering made by silk screening or other permanent embedment of subsurface printed graphics in the material so as to produce a clear, legible sign. Do not place lettering, symbols or markings containing the name of the manufacturer on the signs. The contract number and the year of the contract as given on the Contract Drawings may be placed in small lettering on the front of the sign, if approved by the Engineer.

D. Provide signs for piping and valve identification with two 3/8 inch diameter grommet-protected holes located on the long side center line, the center of the hole to be ½ inch from the edge. Provide nameplates for equipment and structures with four 3/8 inch diameter grommet-protected holes, the center of the hole located ½ inch away from the edges. Provide all holes with suitable brass or stainless steel grommets.

E. Construct all signs and nameplates in conformity with ASTM D523, D638, D646, D790, D792 and D5420.

2.02 DIMENSIONS OF SIGNS AND TAGS

A. Provide identification signs and nameplates rectangular in shape and of the dimensions specified below. A dimensioned tolerance of plus or minus 1/16 inch is permissible.

TYPE OF SIGN	Sign Dimensions (Width x Length)
PIPE IDENTIFICATION -	
1. Outside diameter of pipe (including pipe insulation):	
a. 4 inches and larger	**3-1/2 X 12 INCHES**
b. less than 4 inches	1-1/2 x 7 inches
VALVE IDENTIFICATION -	
1. Valve tags	2 inches diameter
2. Operating stands for valves and sluice gates	1-1/2 x 7 inches
NAMEPLATES -	
1. Equipment and structures	3-1/2 x 12 inches

2.03 LETTERING OF SIGNS

A. Perform all lettering and numbering on identification signs and nameplates in block style in size and spacing to suit the size of sign, as approved by the Engineer.

B. Unless otherwise approved, limit the legend on pipe identification signs to one line and to a total of 12 letters and spaces, and the legend on equipment nameplates to two lines and a maximum of 35 letters and spaces.

C. Submit samples of the lettering to be used for fiberglass reinforced plastic signs to the Engineer for approval before manufacturing begins. Such samples must show the height, width and spacing of letters and numbers for any three (3) legends of ten or more letters and spaces.

2.04 CHEMICAL RESISTANCE

A. Provide fiberglass reinforced plastic signs resistant to abrasion, impact, corrosion, and the following acids, alkalis, salts and solvents in accordance with ASTM D543:

1. 10% citric acid
2. 5% acetic acid
3. 3-30% sulfuric acid
4. 10% ammonium hydroxide
5. 10% sodium chloride

6. turpentine
7. mineral spirits
8. heptane
9. kerosene
10. ethyl alcohol
11. ethyl acetate
12. transformer oil
13. heavy duty detergents
14. water

B. Submit certification on acid resistance to the Engineer prior to installation.

2.05 COLORS

A. Code pipeline signs and equipment nameplates and finish coats of paint for pipe lines and equipment in basic colors.

B. Provide brilliant colors, distinctive shades matching as closely as possible (without custom color blending) the following basic colors as specified by the Munsell Color System (MN):

Table Of Standard Colors	
Color	**Munsell Number**
White	MN - N8.8/
Yellow	MN - 4Y7.5/12.8
Orange	MN - 0.5 YR 4.6/12.2
Red	MN - 7R 3.6/12.7
Brown	MN - 2.5 YR 4.2/4.3
Gray	MN - 2.5PB 5.8/1.7
*Charcoal	MN - 6B 5/0.4
Black	MN - N1/
Blue	MN - 3PB 3.3/7.4
Green	MN - 8G 4.4/6.2
* Provide color "Charcoal" for paints equivalent to MN - N 3.75.	

C. Provide identification signs for pipelines of all sizes, mechanical equipment, sluice gates and valves in the color combinations specified below under "General Color Code".

GENERAL COLOR CODE		
Service Line	**COLORS**	
	Letters	**Background**
HEATING, VENTILATING AND CONDITIONING AIR	Green	Charcoal
(Equipment And Ductwork)	Green	Charcoal

D. Provide vents and drains of the same color combination as the contents of tanks and equipment vented and drained.

2.06 LEGEND FOR PIPE IDENTIFICATION SIGNS

A. Provide identification signs with the following words or abbreviations in color combinations shown to identify the pipe line service:

Pipe Identification Signs			
LEGEND	**Service**	**Color Code**	
		Lettering	**Background**
H.W. RETURN	Hot water return	Blue	Orange
H.W. SUPPLY	Hot water supply	Blue	Orange
* Where shown, specified or required, the legend for blowoff, drain, metering, sump, vent and similar lines shall also include the equipment, structure or identification number to which the service applies.			

B. Number valves in conformity with the Basic Code as specified by the Operation and Maintenance Manual for the plant. Perform color combinations for such lines and valves in the same color combinations as the medium serviced.

2.07 VALVE IDENTIFICATION TAGS

A. Furnish and attach valve identification tags on all valves and controls.

B. Provide round fiberglass reinforced plastic discs tags, approximately 2 inches in diameter, made in conformity with the requirements specified, her in. Provide tags with one 1/8 inch grommet protected hole at the top for fastening to the valve body using 1/16 inch diameter cable and splices or pins as approved. Provide grommets, cable splices and pins of stainless steel or other approved corrosion resistant material.

C. Provide numbering code for the identification tags in conformity with the Basic Code as specified by the Operation and Maintenance Manual for the plant. Assign identification numbers subject to the approval of the Engineer and in conformity with the entire piping and equipment identification system. Provide identification code for each valve and control without duplication. Provide lettering on identification tags not less than 5/16 inch high and limited to two lines. Silk-screen lettering in correct color combination; stenciled or painted numbers and lettering will not be accepted.

2.08 NAMEPLATES

A. Provide nameplates for equipment and structures in the same color combination as the medium they service. Legends for nameplates must follow the terminology shown. Provide numbering system as described in the Operation and Maintenance Manual.

B. The following is a representative list, not necessarily complete, of nameplate legends with appropriate color combinations to which the equipment identification number must be added:

NAMEPLATES			
Legend		**Color Code**	
First Line (1)	**Second Line (2)**	**Lettering**	**Background**
AIR CONDITIONING UNIT	**	White	Charcoal
EXHAUST FAN	**	White	Charcoal
SUPPLY FAN	**	White	Charcoal
ELECTRIC UNIT HEATER	**	White	Charcoal
ELECTRIC DUCT HEATER	**	White	Charcoal

(1) Nominal limit of 18 letters, numerals and spaces.

(2) Nominal limit of 17 letters, numerals and spaces.

*Where equipment is mounted on roofs or where exposed to the public view, such as in lobby or office areas, the color will be selected by the Architect.

**The legend on these nameplates also includes the appropriate six-digit numeral and letter designation for such equipment and structures as specified by the Operation and Maintenance Manual.

**** The legend on these nameplates also includes the appropriate tag number as specified by**

the Operation and Maintenance Manual.

2.09 ADDITIONAL SIGNS AND NAMEPLATES

A. In addition to the legends specified above, the Engineer may order the Contractor to furnish and install additional identification signs, arrows and nameplates at no additional cost to the City. Such additional signs may be requested near completion of the work and will be limited to no more than five (5) signs.

2.10 COLOR OF PIPELINES

A. Paint all pipelines and equipment in conformity with the requirements of Specification 09 90 00 – Painting and Coating. Color code the color of the final coats of paint.

Paint all pipelines and equipment in conformity with the requirements of Specification 09 90 00 – Painting and Coating. Color code the color of the final coats of paint.

B. Match the color of the final coats as closely as possible, without custom blending, to the colors presented in the following table. The colors in this table are identified by their Federal Standard 595B Colors identification number and shall match this standard. The names of the colors in this table are for convenience only.

C. Do not paint aluminum or stainless steel ductwork or jackets on insulated pipelines. Should the specifications state that flanges, flexible couplings, valves and fittings for such jacketed lines not be covered, paint only the flanges, flexible couplings, valves and fittings in accordance with the piping color code.

Pipeline Identification		
ABBR.	**Process/Service Line**	**Fed. Std. 595B Color**
HWR	Hot Water Return (heating)	Orange 12215
HWS	Hot Water Supply (heating)	Orange 11400

D. Do not paint stainless steel, and interior PVC and CPVC pipes. Provide banding for unpainted piping. The color of the bands should be in accordance with the following table. The color band width shall be 6-inches. The color band spacing shall be at 6 foot intervals. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color shall be provided on one of the pipes at approximately 30 inch intervals.

2.11 DUCTWORK

A. All ductwork shall be identified by plastic markers not less than 4 inches high in a color in contrast to the surface on which it is mounted. The markers shall be fastened to the ductwork with sheet metal screws or machine screws and hex nuts. Markers shall indicate system title function. Duct markers shall indicate area served, function, i.e., supply, return or exhaust and direction of flow.

B. Duct markers shall be located not more than 50 feet apart on all mains and branches. Markers shall be placed on ducts on each side of the wall or floor through which they pass. Markers shall also be placed adjacent to access panels. All markers shall be so located as to be clearly visible to a person standing on the floor.

PART 3 - EXECUTION

3.01 LOCATION

A. Locate identification signs for piping along straight line runs at intervals of not more than 30 feet, near valves, branches and junction points and where pipes pass through walls or ceilings. Place direction-of-flow arrows as shown or required. Locate signs on large valves on or adjacent to the valve itself. Place all piping identification signs so as to be easily visible from operating locations. Locate nameplates on equipment bases and on structures at readily visible levels in such positions relative to the equipment and structures so as to prevent damage to the nameplate.

3.02 MOUNTING

A. Mount identification signs and arrows on piping parallel and tangent to the pipe and valves by fastening with screws, plastic or fiber washers, threaded brackets and banding straps and seals. Provide screws and brackets of stainless steel with 5/16 - 18 American Standard Coarse Threads; provide No. 25 U.S. gauge stainless steel, 3/4 inch wide bands.

B. Where pipe is insulated, use care in mounting the signs so to prevent the banding straps from crushing the insulation.

C. Provide mounting assembly "Steelbinder" strapping unit as manufactured by A.J. Gerrard & Co., Des Plaines, Illinois, Independent Metal Strap Co., Inc., Roslyn, N.Y. or approved equal.

D. Mount nameplates in a manner specifically approved by the Engineer after the installation of equipment or construction of structures. Submit details of the method of fastening to the Engineer for approval. Provide fastening devices for nameplates and valves of stainless steel construction.

E. Mount valve identification signs with approved stainless steel brackets or approved stainless steel strapping in such a fashion that sharp corners or edges on signs, brackets, bolts, chain or strapping will not constitute a hazard to personnel operating the valves. Since it is impractical to detail each means of attachment in the Specifications or on the Contract Drawings, each means of attachment will receive approval only on its own merits. Submit for approval sketches of each type proposed.

F. Do not attach identification tags or signs to handwheels. Use of flange bolts or bonnet bolts as a means of attachment of brackets will receive consideration. Provide all attachment devices and bolting of Type 304 stainless steel.

END OF SECTION

SECTION 23 05 80
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. Motors, up to 200 Hp, furnished under other Sections, shall be in conformance with the requirements listed in this Section unless otherwise noted.

C. Motors connected to Variable Frequency Drive Controllers shall be inverter duty rated.

D. All motor overloads shall be coordinated with its associated motor starter and/or VFD.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.04 SUBMITTALS

A. Submittal of motor data for acceptance shall include complete nameplate data per NEMA Standard MG1-10.39 and MG1-10.40 and test characteristics in accordance with NEMA Standard MG1-12.55 "Routine Tests for Polyphase Medium Induction Motors" and, in addition, the following for motors typical of the units furnished:

1. Efficiency at 1/2, 3/4 and full load
2. Power factor at 1/2, 3/4 and full load
3. Motor outline, dimensions and weight
4. Descriptive bulletins, including full description of insulation system
5. Bearing design data
6. Special features (i.e., space heaters, temperature detectors, etc.)

7. Power factor correction capacitor rating and type.

8. Locked rotor current

9. Brake horsepower

10. An outline drawing or an outline data sheet showing complete motor dimensions shall be submitted to cover every motor rated greater than 1/3 horsepower. Several motors of the same type and rating for the same application may be covered by a single drawing or outline sheet. Drawings or sheets shall bear complete identifying data including frame size, speed, horsepower ratings and application for each particular unit.

11. All motor accessories, heaters, detectors, etc., shall be submitted.

12. Certificates of Compliance:

13. Certified copies of motor characteristic curves and all other data necessary for establishing control and protective equipment settings shall be submitted.

14. Operation and maintenance manuals shall be submitted in accordance with the Detailed Specifications.

1.05 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers (IEEE)

B. National Electrical Manufacturers Association (NEMA)

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.06 QUALITY ASSURANCE

A. Routine tests shall be performed on representative motors and shall include the information described on NEMA MG1-12.55 "Routine Tests for Polyphase Medium Induction Motors". Efficiency shall be determined in accordance with IEEE Publication No. 112, Method B. Power factor shall be measured on representative motors.

1.07 SYSTEM DESCRIPTION

A. Motors specified herein are three phase, squirrel cage induction type for 1/2 Hp and above; single phase for less than 1/2 Hp; or DC motors.

1.08 ACCESSORIES

A. General:

1. Motor accessories shall be provided in accordance with the requirements specified under this section unless otherwise stated in the driven equipment specifications.

2. Each outdoor motor 5 horsepower and larger shall be provided with space heaters. 5 horsepower and larger enclosed motors installed indoors in damp, unheated spaces shall also be provided with space heaters.

3. Winding thermal protection, thermostat type shall be provided for each motor in accordance with the following:

   a. Submersible motors and explosion proof motors.

   b. Variable speed motors up to 25 horsepower.

4. Cranes, elevators, hoists, and other devices complying with special safety codes shall be furnished complete with their control equipment, and with all accessories and safety devices for approved safe and efficient operation.

B. Motor Winding Thermal protection

1. Winding thermal protection shall be in accordance with the following:

   a. Thermostats shall be bi-metal disk or rod type embedded in the stator windings. Thermostat contacts shall be automatic reset type, rated 120 volt AC, 5 amps minimum opening on excessive temperature.

   b. Thermistors embedded in each stator phase winding shall be in direct contact with the winding conductors. Each thermistor circuit shall be factory wired to 120 volt solid state control module mounted at the motor in a NEMA 4X box. The control module contacts shall be automatic reset type, rated 120 volt AC, 5 amps minimum opening on excessive temperature.

   c. Resistance temperature detectors shall be 100 ohm precision type with calibrated resistance-temperature characteristics. Detectors, two per phase, shall be positioned to detect highest winding temperature and located between coil sides in stator slots. Detector leads shall be wired to a separate NEMA 4X terminal box.

C. Bearing Temperature Protection:

1. Bearing temperature detectors RTD type similar to the motor winding detectors specified herein, shall be provided on each bearing for horizontal motors and on the thrust bearing for vertical motors.

D. Single Phase Motors: Single phase motors requiring auxiliary starting resistors, capacitors or reactors and switching devices shall be furnished as combination units with such auxiliaries either incorporated within motor housings or housed in suitable enclosures, mounted upon motor frames. Each combination unit shall be mounted upon a single base and shall be provided with a single conduit box.

1.09 PAINTING

A. External Surfaces:

1. All severe duty motors shall have all external surfaces pretreated, primed and painted. External surfaces shall be pretreated so the surface is clean and free of

contaminants. After pretreatment, the surface shall be primed with an oxide primer and then spray painted with a minimum of .003 inch thick epoxy polyamide and semi-gloss coating that is chemical, solvent, salt water, and acid resistant.

2. All other motors shall have external surfaces pretreated, primed and painted in accordance with the manufacturer's standard treatment.

B. Internal Surfaces:

1. All servere duty motors shall have all internal surfaces pretreated, primed and painted. Internal surfaces shall be pretreated so the surface is clean and free of contaminants. After pretreatment, the surface shall be primed with an oxide primer and then painted with an epoxy paint. Machined joints and threaded parts shall be coated with rust inhibiting compound.

2. All other motors shall have internal surfaces pretreated and primed in accordance with the manufacturer's standard treatment.

C. Other Surfaces:

1. All machined bolts and screws and other hardware shall be of the hex head type and shall be zinc plated. Stainless steel hardware shall be used on severe duty motors.

1.10 SPARE PARTS

A. The Contractor shall furnish and deliver to the Engineer, at that part of the site and at such time as the Engineer may direct, spare parts for the electric motors in accordance with the Specifications.

B. The spare parts shall be listed in an index and packed in containers suitable for long term storage, bearing labels clearly designating the manufacturer's part number with complete information for use and reordering.

1. Lubricants: The Contractor shall furnish as part of the bulk lubricant order the quantity of lubricants required to operate and maintain the motors furnished under this section for a period of one year after acceptance. As a minimum, there shall be provided sufficient oil and grease to make a least one lubricant change for each motor as applicable. Replace all lubricants used during startup and testing prior to acceptance of equipment. Furnish this replacement lubricant in addition to the lubricants included in the bulk order.

1.11 DELIVERY, STORAGE AND HANDLING

A. Electric motors shall be delivered, stored and handled in accordance with the Detailed Specifications, the motor manufacturers instructions and the following:

1. Motors shall be inspected for shipping damage when received.

2. All sleeve or oil lubricated bearings motors shall be identified and the bearing reservoirs filled to normal level.

a. Motors shall be handled using motor base lifting lugs. Avoid pounding or bumping of motor which may damage motor. A hoist and spreader bar arrangement shall be used to avoid damage.

b. Motors shall be stored indoors in clean, dry heated areas.

c. Motor space heaters shall be energized to prevent moisture condensation throughout the storage and construction period.

B. Motors shall not be stored in areas subject to continuous vibration. A small quantity of grease shall be injected into each bearing on a monthly basis. Purged grease shall be inspected for water or rust. Motor shaft shall be rotated by hand to check for binding.

PART 2 – PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. RATING

1. Each motor shall develop ample torque for its required service throughout its acceleration range at a voltage 10 percent below nameplate rating. Where shown on the Electrical Drawings to be operated on a reduced voltage starter, the motor shall develop ample torque under the conditions imposed by the reduced voltage starting method. The motor shall not be required to deliver more than its rated nameplate horsepower, at unity (1.0) service factor, under any condition of mechanical or hydraulic loading. All motors shall be continuous time rated suitable for operation in a 40 degrees C ambient unless noted otherwise. Specific motor data such as Hp, rpm, enclosure type, etc, is specified under the specification for the equipment with which the motor is supplied.

B. ENCLOSURE TYPES

1. Motors specified herein shall conform to one of the following standard enclosure designs:

a. Open Drip Proof

b. Totally Enclosed Fan Cooled (TEFC)

c. Totally Enclosed Non-Ventilated (TENV)

d. Explosion Proof

e. Severe Duty

f. Inverter Duty

C. NAMEPLATES

1. The motor manufacturer's nameplates shall be engraved or embossed on stainless steel and fastened to the motor frame with stainless steel screws or drive pins.

Nameplates shall indicate clearly all of the items of information enumerated in NEMA Standard MG1- Part10 or MG1- Part 20, as applicable.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 THREE PHASE MOTORS-FRAMES 143T THROUGH 449T

A. General

1. Unless otherwise specified, motors 1/2 Hp and larger shall be 3 Phase, squirrel cage induction type.
2. All motors 3/4 Hp and larger shall be a NEMA frame 143T or larger. 1/2 Hp motors and 3/4 Hp motors rated 1800 and 3600 rpm, shall be a 56 frame. Motors shall be designed and connected for operation on a 480 Volt, 3 Phase, 60 Hz alternating current system. Dual voltage (230/460) rated motors are acceptable.
3. Unless otherwise required by the load, all motors shall be NEMA Design B, normal starting torque. Locked rotor kVA/Hp shall not exceed Code Letter G as described in NEMA Standard MG1-10.37 for motors 20 Hp and larger.
4. Motors connected to variable frequency drives shall be inverter duty rated.
5. Motors shall be by U.S. Electrical Motors, Division of Emerson Electric Co., or equal.

B. Bearings

1. Anti-friction motor bearings shall be designed to be regreasable and initially shall be filled with grease suitable to ambient temperature of 40 degrees C. Bearings shall be ABMA Types BC or RN, heavy duty, or shall otherwise be shown to be suitable for the intended application in terms of B-10 rating life, Class M3 or better.
2. All grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic type by the Alemite Division of the Stewart-Warner Corporation.

C. Insulation

1. Insulation systems shall be Class F, operated at Class B temperature rise and shall be manufacturer's premium grade, resistant to attack by moisture, acids, alkalies and mechanical or thermal shock for 480 Volt motors. Provide 80 degree C, Class

B rise or better by resistance at 100 percent load and provide a Class F insulation system, suitable for an ambient temperature motor operation of 0 to 40 degree C at no more than 3300 feet above sea level for medium voltage motors. This temperature rise shall be met when motors are operated and controlled with the VFD(s). The motor insulation system shall have full capability to handle the common mode voltage conditions imposed by the VFD.

2. Motors for outdoor service shall have vacuum/pressure impregnated epoxy insulation for moisture resistance.

3. Insulation for inverter duty motor windings shall meet or exceed the Pulse Endurance Index for magnetic wire and shall not be injured when exposed to repeated pulse type waveforms, repetitive high voltage transients, switching frequency and rate of rise of the pulse. Class H varnish shall be used.

D. Enclosures

1. Motors shall have a steel or cast iron frame and a cast iron conduit box, as specified below. Conduit box shall be split from top to bottom and shall be capable of being rotated to four positions. Synthetic rubber-like gaskets shall be provided between the frame and the conduit box and between the conduit box and its cover. Motor leads shall be sealed with a non-wicking, non-hygroscopic insulating material. A frame mounted pad with drilled and tapped hole, not less than 1/4-in diameter, shall be provided inside the conduit box for motor frame grounding.

2. Totally enclosed fan cooled: TEFC motors shall have a steel or cast iron frame, cast iron end brackets, cast iron conduit box, 1.15 service factor at 40 degrees C, tapped drain holes (corrosion resistant plugs for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger) and upgraded insulation by additional dips and bakes to increase moisture resistance.

3. Totally enclosed non-ventilated: TENV motors shall include the same rating and accessories as specified for TEFC motors.

4. Severe duty: Motors shall be of the corrosion resistant type conforming to motors designated by the manufacturer as "Corro-Duty", "Mill and Chemical", "Custom Severe Duty", or similar quality designation. Severe duty motors shall have a cast iron frame, cast iron end brackets, cast iron conduit box and 1.15 service factor at [40] degrees C and tapped drain holes (corrosion resistant plug for frames 286T and smaller and automatic breather/drain devices for frames 324T and larger).

E. Inverter Duty Rated Motors

1. Inverter duty rated: Motors for operation on variable frequency drives shall meet current power quality levels published in NEMA MG1, Part 31. Consideration shall be given to the primary factors of the variable frequency drive such as the modulation scheme (six-step, PWM, etc), the switching or carrier frequency and the type of power output devices utilized (IGBT etc). Consideration shall also be given to the installation methods such as output cable length, cable installation method, installation of output filters, etc. Enclosures shall be equal to those

furnished for severe duty or explosion proof motors. Motor non- drive end bearings shall be insulated. Internal service factor shall be 1.0 that of the nameplate. Unless otherwise noted provide enclosures suitable for “severe duty”. Motors shall be furnished with an internal thermal switch. Ventilation system shall be designed for maximum heat transfer. Stator laminations shall be stagger-stacked and stamped from high grade electrical steel to minimize eddy-current losses and heat build-up caused by inverter induced harmonics. Rotors shall be configured to minimize skin-effect heating.

F. Motor Efficiencies

1. Three phase motors rated 1 Hp and larger shall be of the premium efficiency type. Motors shall have a NEMA Nominal Efficiency not less than the values indicated below. Efficiency values shall be based on tests performed in accordance with IEEE Publication No. 112, Method B. Motors with horsepower or rpm's not listed shall conform to comparable standards of construction and materials as those for listed motors.

2. Where State Energy Codes or Utility Company Energy Rebate Programs dictate higher efficiencies than those listed, the higher efficiency motors shall be furnished.

OPEN MOTORS

	3600 RPM	1800 RPM	1200 RPM	900 RPM
Hp	Nominal Efficiency	Nominal Efficiency	Nominal Efficiency	Nominal Efficiency
1.0	--	85.5	82.5	--
1.5	85.5	86.5	86.5	--
2.0	86.5	86.5	87.5	--
3.0	86.5	89.5	89.5	--
5.0	89.5	89.5	89.5	--
7.5	89.5	91.0	91.7	--
10.0	90.2	91.7	91.7	--
15.0	91.0	93.0	92.4	--
20.0	92.4	93.0	92.4	92.4
25.0	93.0	93.6	93.0	92.4
30.0	93.0	94.1	93.6	93.6
40.0	93.6	94.1	94.1	93.6
50.0	93.6	94.5	94.1	93.6
60.0	94.1	95	95.0	94.1
75.0	94.5	95	95.0	94.5
100.0	94.5	95.4	95.0	95.0
125.0	95.0	95.4	95.4	95.0
150.0	95.4	95.8	95.8	95.0
200	95.4	95.8	95.4	95.4

ENCLOSED MOTORS

Hp	3600 RPM Minimum Nominal Efficiency	1800 RPM Minimum Nominal Efficiency	1200 RPM Minimum Nominal Efficiency	900 RPM Minimum Nominal Efficiency
1.0	80.4	85.5	82.5	83.5
1.5	85.5	86.5	87.5	84.9
2.0	86.5	86.5	88.5	85.5
3.0	88.5	89.5	89.5	85.7
5.0	89.5	89.5	89.5	89.9
7.5	91	91.7	91.7	90.6
10.0	91.7	91.7	91.7	90.3
15.0	91.7	92.4	92.4	90.7
20.0	92.4	93.0	92.4	91.6
25.0	93.0	93.6	93.0	91.8
30.0	93.0	93.6	93.6	92.7
40.0	93.6	94.1	94.1	93.0
50.0	94.1	94.5	94.1	93.4
60.0	94.1	95.0	94.5	93.3
75.0	94.5	95.4	95.0	94.5
100.0	95.0	95.4	95.4	94.7
125.0	95.4	95.4	95.4	95.1

2.04 SINGLE-PHASE MOTORS

A. Unless otherwise specified, motors smaller than 1/2 Hp shall be single phase, capacitor start. Small fan motors may be split-phase or shaded pole type if such are standard for the equipment. Wound rotor or commutator type single-phase motors are not acceptable unless their specific characteristics are necessary for the application.

B. Motors shall be rated for operation at 115 Volts, single phase, 60 Hz.

C. Locked rotor current shall not be greater than specified in NEMA Standard MGI-12.37, Design "N".

D. Motors shall be provided with sealed ball bearings lubricated for 10 years normal use.

E. aa Motors shall be totally-enclosed in conformance with NEMA Standards. Small fan motors may be open type if suitably protected from moisture, dripping water and lint accumulation.

F. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

G. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

H. Motors 1/20 HP and Smaller: Shaded-pole type.

I. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Motors shall be installed in accordance with manufacturer's instructions and recommendations.

B. Each motor shall be carefully and properly aligned with the driven equipment.

C. Equipment shall be secured to mounting surface with anchor bolts. Anchor bolts shall be provided meeting manufacturer's recommendations and of sufficient size and number to secure equipment.

D. Motor nameplates shall be installed for identification of equipment. Nameplates shall be provided.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform testing, adjusting and balancing of all Heating, Ventilation and Air Conditioning Systems as specified or required for proper operation.

1.02 PAYMENT

A. Payment for work furnished and installed under this Section shall be as specified in the Specifications.

1.03 REFERENCES

A. Reference Standards: Comply with applicable provisions and recommendations of the following except as shown or specified:

1. ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.), Systems Volume, Latest Edition.
2. Test, adjust and balance systems in accord with:
    a. Associated Air Balance Council (AABC): National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems (AABC-MN-1).
    b. National Environmental Balancing Bureau (NEBB): Procedural Standards for Testing Adjusting Balancing of Environmental Systems (NEBB-01).
    c. AABC "National Standards for Field Measurements, Total System Balance, Air Distribution, Hydronics Systems, Volume One Number 81266".

1.04 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the Division 1 - General Requirements of the Specifications.

B. Data Sheets:

1. Submit samples of data sheets on each item of equipment for approval.
2. Submit data sheets on each item of testing equipment required.
3. Include name of device, manufacturer's name, model number, latest date of calibration, and correction factors.

C. Report Forms:

1. Submit specimen copies of report forms for Engineer's approval.
2. Forms shall be 8-1/2 by 11-inch paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
3. Reports shall be on the organizations approved forms imprinted with the company's name.
4. Certified report outlining procedure used to balance the system and the types of measuring devices used.

D. Test results shall be submitted on approved forms in a typed format.

E. Submit certified copies of required test reports to the Engineer for approval.

1.05 QUALITY ASSURANCE

A. Balancers Qualifications:

1. Submit work experience or resume of proposed biographical data on employee who will directly supervise the Testing, Adjusting and Balancing Work.
2. Submit proof of certification by NEBB (National Environmental Balancing Bureau), AABC (Associated Air Balance Council), or SMACNA (Sheet Metal and Air Conditioning Contractors' National Association), or demonstrate that the standards and experience required for certification are possessed, all to the satisfaction of the Engineer.
3. Submit a record of at least 5 years' experience in the testing and balancing contracting industry, engaged in heating, ventilating, and air conditioning work.

1.06 JOB CONDITIONS

A. In accordance with the requirements of Division 1 of the Specifications, heating, ventilating, air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the test, adjust and balance work specified.

B. Reports shall be certified by the testing engineer that the methods used and the results achieved are as specified.

1.07 CORRECTIVE ADJUSTMENTS

A. Should corrective measures caused by faulty installation require retesting, adjusting and balancing, such work shall be performed at no additional expense to the City.

B. Inspections:

1. Fan Belt Deflection: No less than 1/4-inch or more than a 1/2-inch.
2. Finned Coils: Plate type fins shall be combed out with a fin comb for appropriate fin spacing. Helical fins shall be straightened with blunt bladed instrument.

PART 2 – PRODUCTS

2.01 INSTRUMENTS: GENERAL

A. Contractor shall provide all necessary instrumentation, tools, ladders, etc. to complete all air balancing tests and adjustments.

B. Instrumentation shall be in accordance with NEBB, AABC, or SMACNA requirements and shall be calibrated to the accuracy standards demanded by these organizations.

C. Flow-measuring hoods (manufactured, not fabricated) shall be acceptable for measurement of ceiling diffuser performance only.

D. Contractor shall assume full responsibility for safe keeping of all instrumentation during the course of work.

2.02 AIR BALANCE INSTRUMENTS

A. Provide all velometers, anemometers, pitot tubes, differential air pressure gages, manometers, hook gages, static pressure probe units, etc. as may be required to perform all air balance tests of HVAC equipment, ducts, registers, grilles, etc.

2.03 WATER BALANCE INSTRUMENTS

A. Provide manometers, pressure gages, and other instruments and accessories as required to balance the water system.

2.04 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

A. Provide insertion thermometers, sling psychrometers, tachometers, revolution counters, clamp-on volt-ammeter recorders, and other instruments as required to measure all facets of the complete HVAC system performance.

PART 3 – EXECUTION

3.01 GENERAL

A. All testing, adjusting, and balancing of air and hydronic systems shall be performed in compliance with the standard procedure manual published by the testing, adjusting, and balancing organization affiliated with the Contractor. Contractor shall submit one copy of the standard procedure manual to the Engineer for his records.

B. Contractor shall be solely responsible for the protection and safeguarding of his work and shall provide every protection against accidents, injury, and damage to persons and property.

C. Contractor shall keep dust, dirt, and debris to an absolute minimum and reinstall all removed ceiling components to their original positions at the end of each day.

D. Contractor shall be fully responsible for removal and reinstallation of ceiling system and replacement of any component damaged.

E. Contractor shall install additional access panels at no extra cost to the City, as is required to gain access to equipment concealed above ceilings, behind walls, or any other concealed space.

F. Air systems shall be tested, adjusted, and balanced with clean filters.

G. Hydronic systems shall be tested, adjusted, and balanced with clean strainers.

3.02 INSPECTION

A. The Contractor shall conform to the requirements of Division 1 of the Specifications.

B. Equipment Check:

1. Verify proper overload heater sizes.
2. Verify function of safety and operating controls.
3. Verify proper operation of equipment.
4. Report on inspection, observation and checking procedures.

3.03 TESTING OF EQUIPMENT AND DUCT

A. In addition to any other references to testing specified in Division 1, the Contractor shall be bound by this section of the Specification to test and adjust all systems and accessories covered under this Contract. The Contractor shall also comply with the requirements of testing as outlined in the individual sections. Furthermore, he shall operate and maintain these systems for certain periods of time as specified herein, and shall leave them in good working order. The Contractor shall provide all necessary equipment and labor for this work.

B. All piping systems shall be thoroughly cleaned by flushing with water, disinfected, and tested by the Contractor for tightness. Prior to testing all other piping systems, the Contractor shall submit a test procedure for each system to the Engineer for review. Pipe lines shall be flushed at a rate of at least 2.5 feet per second for a duration of minimum one hour. The units and control valves shall be isolated before flushing. The pipe line shall be flushed again after opening the valves at the units. In general, piping shall be tested hydrostatically at 1-1/2 times the maximum design pressure for which the system is intended, but not less than 100 psi. The line shall be filled with water for a period of not less than 6 hours, then subject to the indicated test pressure. Duration of test pressure shall be four (4) hours. During the pressure test there shall be no leakage. All air shall be purged from the line before pressure testing. Any leak shall be repaired in a manner acceptable to the Engineer and the system retested until all such piping shows tight.

C. All ductwork systems including air outlets shall be tested, adjusted and balanced for within limits of the required airflows as indicated on Drawings and specified in this Section.

D. After all final tests have been performed on all equipment and on all sub-systems installed under this Contract, including the testing of all controls specified in other Sections, and after the results from all such testing have been accepted, the Contractor shall test the overall system by demonstrating its ability to respond properly to normal

changes in controlled parameters, as well as to system upsets. To facilitate this, he shall make available a minimum of two men, thoroughly familiar with the systems and equipment installed under this Contract, for a minimum of seven (7) days to test the system by changing controlled parameters and generating system upsets as directed by the Engineer, and demonstrating that the sequential action appropriate to the particular change or upset occurs automatically. Where actual change or upset is not feasible, the Contractor shall simulate the change or the upset. Controlled parameter changes shall include, but not necessarily be limited to, any change in temperature, pressure, flow rate, fluid level, load, etc., which should result in an automatic change in the position of a control valve or control damper, in the output rate of a piece of equipment, in the normal start-up or shutdown of equipment, etc. The change in the state of the controlled device or equipment shall be shown to result in a corrective action on the controlled parameter. Upsets shall include, but not necessarily be limited to, any condition which should cause annunciation of an alarm, safety shutdown of equipment, startup of standby equipment, closing of fusible-link devices, lifting of relief valves, etc. The Contractor shall immediately restore to its original state any safety device, the state of which has been changed by its having been tested.

E. Contractor shall immediately correct any system deficiency that should come to light during testing.

F. After the overall system testing has been completed, and after all final adjustments have been made, the Contractor shall operate and maintain all new systems and equipment, site-wide, associated therewith, for a period of thirty consecutive days. During this period all normal maintenance (filter replacements, strainer cleaning, periodic checks of safety devices, datalogging, etc.) shall be performed by the Contractor. If, during this period, any work beyond routine maintenance of equipment and materials installed under this Contract, should be required to maintain proper operation of the overall system, the elapsed time shall be forfeited, and a new thirty day period shall commence following the completion of the corrective action.

3.04 BALANCING AND ADJUSTING

A. In addition to any other reference to balancing and adjusting specified elsewhere in these specifications, the Contractor shall be bound by this portion of the specifications to balance, adjust and leave in good working order all systems and accessories covered under this Contract.

B. The Contractor shall procure the services of an independent balancing and testing agency which specializes in the balancing and testing of heating, ventilating and air conditioning systems to balance, test and adjust all systems installed under this Section.

C. The Contractor shall advise the Engineer at least two weeks in advance of the date scheduled for balancing to commence; at the Engineer's discretion, the balancing shall be conducted in the Engineer's presence.

D. At least three (3) months prior to the commencement of balancing, the Contractor shall forward a detailed explanation of the balancing procedure to the Engineer for

review. In general, the method shall conform to those specified by the Associated Air Balance Council or SMACNA.

E. All piping systems shall be balanced under this Section to provide the flows indicted on the Contract Drawings or in the Specifications.

F. Air systems shall be balanced before all hydronic systems.

G. Before beginning to balance the air systems the Contractor shall check, in the presence of the Engineer, all filters and coils for cleanliness, dampers (automatic, volume and fire) for correct position, all fans for proper rotation, and temperature controls for minimum completeness to allow for proper balancing. If any of the above or other conditions are found which would not allow for proper balancing the Contractor shall take the necessary corrective actions, at his own expense, before balancing begins.

H. All heating, ventilating, and air conditioning systems shall be balanced by the Contractor by adjustment of dampers, fan sheaves, apparatus and air outlets to provide the air quantities indicated on the Contract Drawings. If necessary, adjustments of air outlets shall be made to eliminate drafts.

I. Balancing for all air systems shall be accomplished in a manner to first minimize throttling losses, then fan speed shall be adjusted to meet design conditions. All air outlets and fans shall be balanced within **5 percent** of the design capacity.

J. Balancing for all hydronic systems shall be accomplished in a manner that results in the balancing valve which is hydraulically furthest from the pumps having a pressure drop of five feet at design flow, unless when wide open its pressure drops exceeds five feet, in which case, it shall be left wide open. (Inadequate pressure drop renders flow readings inaccurate; excessive pressure drop imposes needless additional head on the pumps). Balancing for the remainder of the system shall be accomplished in a manner to first minimize throttling losses. When variable speed drives are provided, pumps speed shall then be adjusted to meet design flow conditions. For each constant speed pump system having a pump motor greater than 10 HP, the following procedure shall then be followed:

1. Record the pressure head across the pump, and the actual flow rate.

2. For closed systems, multiply this pressure drop by the square of the ratio of the design flow to the actual flow. For open systems, include compensation for static head in performing this calculation.

K. Pump flows shall be balanced within **5 percent** of the specified capacity.

L. After the systems have been balanced, the Contractor shall submit and certify to the City, a list containing the following minimum information for air outlets and equipment:

1. Room or facility served.

2. Size, quantity and model of air outlet or equipment.

3. Type of air outlet or equipment.

4. Air flow indicated on Contract Drawings.

5. Air flow measured.

6. GPM indicated on Contract Drawings.

7. GPM measured.

8. Entering and leaving water temperatures.

9. Fan cfm indicated on the Contract Drawings.

10. Fan cfm measured.

11. Fan motor running amps.

M. The Contractor shall advise the Engineer two days in advance of the start-up of the heating and cooling water circulating systems. To be ready for start-up, the boilers, chillers, condensers and pumps and related equipment must be "off", and the system must be filled, purged, balanced and cool.

N. The Contractor shall record the following:

1. Pressure at system fill valve.

2. Pressure at pumps (inlet or outlet).

3. Pressure at building piping entries.

4. System temperature.

O. The Contractor shall start the pumps and record the following pressures:

1. System fill valve.

2. Pump inlets.

3. Pump outlets.

4. Building piping entries (supply and return).

P. The Contractor shall start heating and/or cooling equipment. Once system design temperature has been reached, and system is in equilibrium, again record the pressures listed above, as well as the temperatures at the inlets and outlets of the boilers, chillers, condensers, coils, heat exchangers and where required in Specifications.

Q. The Contractor shall submit all recorded data to Engineer for review.

R. The Contractor shall adjust any or all equipment which, in the City's opinion, is not set within acceptable limits of **±5 percent.**

3.05 AUTOMATIC CONTROL SYSTEMS

A. In cooperation with the control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations.

B. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by control system installer.

3.06 MARKING OF SETTING

A. Following approval of testing, adjusting and balancing (TAB) Verification Report, the setting of all HVAC adjustment devices including valves, and manual dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

3.07 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Dual-service heating and cooling piping, indoors.

B. Related Sections:

1. Section 23 20 02 HVAC Pipe and Pipe Fittings.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General" and "Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
7. Service temperature range – 450 F to 900 F

G. Mineral-Fiber, Preformed Pipe Insulation:

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

    a. Johns Manville; a Berkshire Hathaway company.
    b. Knauf Insulation.
    c. Owens Corning.
    d. Approved equal.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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

   a. Aeroflex USA, Inc.
   b. Armacell LLC.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Approved equal.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Approved equal.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Approved equal.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.

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

    a. Dow Corning Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. P.I.C. Plastics, Inc.
    d. Approved equal.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

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

    a. Foster Brand; H. B. Fuller Construction Products.
    b. Knauf Insulation.
    c. Vimasco Corporation.
    d. Approved equal.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller Construction Products.
    c. Vimasco Corporation.
    d. Approved equal.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.06 SEALANTS

A. Joint Sealants:

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

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller Construction Products.
    d. Pittsburgh Corning Corporation.
    e. Approved equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

2.08 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.09 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and pre-sized a minimum of 8 oz./sq. yd.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

2.11 TAPES

A. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 4 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
4. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
7. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly

with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.08 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as shown in the table below. Vary first and second coats to allow visual inspection of the completed Work.

3.09 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Dual-Service Heating and Cooling, 40 to 200 Deg F: Insulation shall be one of the following:

1. Cellular Glass
2. Mineral-Fiber, Preformed Pipe, Type I

B. Pipe Insulation Thickness Table:

Minimum Pipe Insulation Thickness (in. inches)

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	Insulation Conductivity		Nominal Pipe or Tube Size (inches)				
	Conductivity Btu*in./(h*ft 2*° F)	Mean Rating Temperature, °F	¾ & less	1 to 1-1/4	1-1/2 to 3	4 to 7	8 & larger
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	3.0	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.5	1.5	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	1.5	1.5	1.5	1.5	1.5
< 40	0.20 – 0.26	50	1.5	1.5	1.5	1.5	1.5

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Concealed:

1. None.

C. Piping, Exposed:

1. PVDC: 30 mils thick.

END OF SECTION

SECTION 23 20 02
HVAC PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish, install, test and place into satisfactory operation all pipe and pipe fittings complete with auxiliary equipment and accessories as shown on the Contract Drawing and specified herein.

B. Painting of piping will be performed under this Contract.

1.02 RELATED SPECIFICATIONS

A. Specification 09 90 00 - Painting and Coating

B. Specification 23 05 93 - Testing, Adjusting, and Balancing for HVAC

C. Specification 03 30 00 - Cast-In-Place Concrete

D. Specification 23 05 53 - Identification for HVAC Piping and Equipment

E. Specification 23 07 19 - HVAC Piping Insulation

F. Specification 23 05 23 - General-Duty Valves for HVAC Piping

1.03 REFERENCES

A. Products and construction shall be in accordance with the following standards and specifications unless otherwise noted in this document. In case of conflict, the standard with more stringent requirements shall apply.

1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
2. American Society of Plumbing Engineers (ASPE).
3. American Water Works Association (AWWA).
4. American Society for Testing and Materials (ASTM).
5. American National Standard Institute (ANSI).

1.04 SUBMITTALS

A. General:

1. In accordance with the procedures and requirements set forth in the General Conditions and Division 01, the Contractor shall obtain from the piping manufacturer and submit the following data:

   a. Shop Drawings.

   b. Results of Certified Shop Test.

   c. Certified Letters of Compliance.

   d. Samples

2. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

3. Each submittal shall be identified as specified in the General Conditions and Division 01, noting specification section and paragraph number.

B. Shop Drawings:

1. Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed piping material's compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the Contractor disapproved without review.

2. Data to be submitted shall include but not be limited to:

   a. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the piping system and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.

   b. Complete layout and installation drawings with clearly marked dimensions. Piece numbers which are coordinated with the tabulated pipe layout schedules shall be clearly marked. Scale and size of the drawings shall conform to the specifications in the General Conditions and Division 01. Piping layout drawings shall indicate the following information on pipe supports, location, support type, hanger rod size, insert type and the load in pounds.

   c. Weight of all component parts.

d. Tabulated pipe layout schedule shall include the following information for all pipe and fittings, service, pipe size, working pressure, wall thickness, piece number and laying length.

e. All welds to be made in the field shall be prominently and individually marked on the shop drawing with a note, such as "Field Weld" and the pertinent weld data in accordance with AWS standards.

C. Results of Certified Shop Tests

1. The Contractor shall obtain from the manufacturer and submit to the Engineer copies of the certified shop tests in accordance with the General Conditions and Division 01.

D. Certified Letters of Compliance

1. The Contractor shall obtain from the manufacturer and submit to the Engineer copies of certified letters of compliance in accordance with the General Conditions and Division 01.

1.05 QUALITY ASSURANCE AND QUALIFICATIONS

A. General

1. The pipe and fittings covered by these specifications shall be provided by the Contractor through qualified manufacturers experienced in the fabrication, casting and manufacture of the pipe materials specified herein. The pipe and fittings shall be designed, fabricated and installed in accordance with the best practice of the trade and the standards specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Special care in handling shall be exercised during delivery, distribution and storage of pipe to avoid damage and setting up stresses. Damaged pipe will be rejected and shall be replaced at the Contractor=s expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.

B. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

C. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

D. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 PIPE AND PIPE FITTINGS

A. General:

1. All pipe and fittings shall be marked with the manufacturer's name or trade mark, size, class, and the date of manufacture in accordance with the standards specified herein.

2. All bolts and nuts shall be hexagonal conforming to ANSI B18.2 and be A 307 Grade B except as noted.

3. All wall pipes with nominal pipe sizes 30 inches and smaller shall be ductile or gray cast iron unless otherwise designated herein or on the Contract Drawings.

4. Nomenclature for nominal pipe size ranges shall be as follows: "to" means all pipe sizes within the listed range including the upper listed size and "up to" means all pipe sizes within the listed range not including the upper listed size.

B. Gaskets:

1. All gaskets shall be full faced type conforming to ANSI B16.21 except for lap joints and 300 lb flanges.

C. All hangers, hanger rods, hanger hardware, and inserts for HVAC Hot Water pipe system shall be fabricated of 316 stainless steel. All hangers, hanger rods, hanger hardware, rollers and inserts shall be manufactured by Grinnell Company, Carpenter Patterson, Basic Engineers Inc., or approved equal.

D. A schedule of piping materials is included at the end of this Section. The schedule shall indicate service, nominal pipe size, material, wall thickness, joint type, working pressure, coatings and linings.

2.02 CARBON STEEL PIPE AND FITTINGS FOR HOT WATER SYSTEM

A. General:

1. Shall conform to ASTM A53, Type S, Grade B for nominal pipe sizes 2 inches to 24 inches.

2. Shall conform to ASTM A106, for nominal pipe sizes less than 2 inches.

B. Wall Thickness:

1. Shall be as specified in the pipe scheduled.

C. Joints:

1. Shall be flanged, welded, or threaded as specified in the pipe schedule.

2. The pipe ends shall be prepared for the jointing system specified for the pipe. Ends for welding shall be beveled in accordance with ANSI B31.8 at 30 degrees with a maximum of 37-1/2 degrees.

3. Threaded joints shall be used only for nominal pipe sizes below 3 inch. Pipe threads shall conform to ANSI B2.1. All threads shall be clean, machine cut, and all pipe shall be reamed before erection. Each length of pipe as erected shall be up-ended and rapped to dislodge dirt and scale. Screwed joints shall be made up with good quality thread compound and applied to the male thread only. After having been set up, a joint must not be backed off unless the joint is completely broken, the threads cleaned and new compound applied. All joints shall be air tight.

D. Fittings:

1. For threaded joints shall be for nominal pipe sizes less than 3 inch or as specified in the pipe schedule, class 150 lb banded malleable iron threaded fittings made in conformance with ANSI B16.3.

2. For flanged and welded joints, shall conform to the dimensional requirements of ANSI B16.5 Standard for Pipe Flanges and Flanged Fittings or ANSI B16.9 Factory-Made Wrought Steel Butt Welding Fittings. Fittings fabricated in conformance with ANSI B16.9 shall be of the same wall thickness as specified for the pipe and shall have tangents for slip on type flanges.

3. Manifold fittings shall be fabricated as dimensioned on the plans.

4. Bell type reducers shall not be acceptable; only cone type reducers shall be used.

E. Coatings and Linings For Pipe and Fittings:

1. Shall be as specified in the pipe schedule.

2. A coat of rust inhibitive primer in conformance with General Specification 09 90 00 – Painting and Coating shall be applied, before shipment, to the exterior of the pipe where specified.

3. The pipe and fittings shall be cement mortar lined to the standard thickness in accordance with AWWA C205 as specified in the pipe schedule. The lining shall be shop applied. A seal coat of asphaltic material shall be applied as specified in ANSI A21.4 (AWWA C104).

2.03 UNIONS

A. For carbon steel pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39 with ground joints.

2.04 INSULATING TYPE FITTINGS

A. When joining two pipes of dissimilar materials, insulating type fittings shall be used to prevent galvanic action.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. The Contractor shall furnish all labor, tools, materials, and equipment necessary for installation and jointing of the pipe. All piping shall be installed in accordance with the Contract Drawings in a neat workmanlike manner and shall be set for accurate line and elevation. All piping shall be thoroughly cleaned before installation, and care shall be taken to keep the piping clean throughout the installation.

2. Before setting wall sleeves, pipes, castings and pipes to be cast in place, the Contractor shall check all Contract Drawings and Figures which may have a direct bearing on the pipe locations. The Contractor shall be responsible for the proper location of the pipes and appurtenances during the construction of and renovation of the tanks and structures.

3. Piping shall be attached to pumps, valves, equipment, etc., in accordance with the respective manufacturers' recommendations.

4. For piping assembled with threaded, solvent cemented, welded or soldered joints, liberal use of unions shall be made. Unions shall be provided close to main pieces of equipment and in branch lines to permit ready dismantling of piping without disturbing main pipe lines or adjacent branch lines. A minimum of one union per straight run of pipe between fitting and/or valves with multiple lengths of pipe shall be used. Unions shall be placed downstream of the shut off or isolating valves.

5. All changes in directions or elevations shall be made with fittings except as noted in the piping paragraphs.

6. Conflicts between piping systems and equipment or structures shall be presented to the Engineer for determination of corrective measures before proceeding with the pipe installation.

7. Piping shall not run above motor control centers, control panels or other electrical equipment unless directed by the Engineer. Piping which must run above electrical equipment shall be provided with suitable drip pans; any liquid collected in the drip pans shall be piped to the nearest floor drain.

8. Pipe hangers for hot water piping shall be adjustable swivel clevis roller type with pipe covering protection saddles. Prior to installation of any piping, the Contractor shall submit drawings of all pipe supports and methods of attaching them to the building construction, to the Engineer for his review. Chain, strap, perforated bar, wire, or rope shall not be used for supporting piping. All pipe supports, rods or inserts embedded in concrete shall be 316 stainless steel. When hanger rods are over 18 inches in length, lateral bracing to the structure shall be provided every fourth hanger.

9. Where specified, pipe supports shall be sized to fit over the pipe and insulation thereby allowing the insulation to pass through the pipe support without interruption. Load distribution sheet metal shields shall be positioned between the insulation and the pipe supports. The shield shall have a round contour to match the curvature of the pipe insulation and shall cover the lower 180 degrees of the pipe insulation circumference.

10. Piping shall be installed free of traps and with sufficient slope so that all of the various piping systems may be drained to one or several points. In the event that it is impossible to drain to a common point due to structural obstructions and finished ceiling heights, furnish and install all additional drain valves that may be necessary to completely drain piping systems. Location of all drain valves shall be approved by the Engineer before installation.

B. Joints:

1. Flanged Joints:

a. Shall be made up with full face gaskets as specified in the piping paragraphs.

b. Shall have the flange faces bearing uniformly on the gaskets.

c. Shall have the flanges drawn together uniformly until the joint is tight.

d. No washers shall be permitted for the bolt and nut assemblies.

e. The length of the bolts shall be uniform and in accordance with the standards specified herein. The bolt's maximum projection beyond the end of the nut shall be 0.25 inch nor shall the bolt fall short of the end of the nut.

C. Welded Joints:

1. Shall be shop welded in accordance with the standards and specifications contained herein.

2. Field welding shall be permitted for black carbon steel pipe in non-hazardous (non-explosive) areas only and if it can be demonstrated that the interior of the pipe can be satisfactorily lined and inspected. Welding in the field shall be performed only when requested on the shop drawings and approved by the City and the Engineer in writing as specified herein. Piping for hazardous areas shall be shop welded, brought to the site in segments and installed using flanges.

3. All welding shall be performed in accordance with ANSI B31.1 and AWWA C206 except as modified or supplemented herein. All welders shall be AWS certified in accordance with AWWA C206, and ANSI B31 requirements. Welders shall have their current certificate available for the Engineer's inspection.

a. Each welder shall be required to identify his weld with his specific code marking signifying his name and number assigned.

b. For piping systems with service temperatures in excess of 120 degrees F, each welder shall be examined at the job site by the Contractor in the presence of the Engineer to determine the ability of the welder to meet the qualifications required. Welders shall be tested for all positions including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall be allowed to weld only in the position in which he has qualified. It shall be the Contractor's responsibility to assign only the site tested welders to this piping.

c. When a welder fails to meet the prescribed welding qualifications and/or fails an on-site examination, or is responsible for a defective weld, that welder shall be retested on the job site. If he fails a second on-site examination he shall be disqualified for work on the project.

4. Pipe and fittings with wall thicknesses of 3/16 inch and larger shall have ends beveled for welding. Bevels shall be 30 degrees with a maximum of 37-1/2 degrees.

5. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping.

6. Welding shall be continuous around the joint and shall be completed without interruption.

7. Welds shall be of the single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee.

8. Welds shall be free from cold spots, pin-holes, oxide inclusions, burrs, snags, rough projections or other defects.

9. Filler metal for welding shall be of the same composition as the base metal.

10. All welding of steel pipe flanges shall be in accordance with requirements of AWWA C207 and ANSI B31.1.

11. Field repairs of cement mortar lining at welding joints shall be made in accordance with AWWA C205 Appendix A or AWWA C602.

12. The location of proposed field welded joints shall be shown on the shop drawings and approval obtained from the Engineer at the time of submission.

13. Split welding rings shall be used for field joints on pipes with nominal pipe sizes over 3 inches to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe.

14. Field welds shall be "fixed position" type.

15. All field welds shall be dye tested and visually inspected.

16. All welds shall be hydrostatically tested.

17. Defective welds shall be replaced and reinspected. Repairing defective welds by adding welding material over the defect or by peening will not be permitted. Welder responsible for defective welds must be requalified.

18. For piping with all welded joint indicated, flanges shall be located at all valves and equipment and where needed for piping installation. All flanged joints locations shall be clearly indicated on the shop drawings.

D. Threaded Joints:

1. All threads shall be clean, machine cut and all pipe shall be reamed before erection.

2. Taps and dies shall be cleaned, sharpened and in good condition.

3. All threaded joints shall be made tight with teflon tape.

4. After having been set up, a joint shall not be backed off unless the joint is broken, the threads cleaned, and new tape is applied.

3.02 PIPE SUPPORT SYSTEMS

A. General:

1. All supports and parts required for the installation of the piping systems shall conform to the requirements of Chapter 11, Part 5 of the ANSI Code for Pressure Piping (B-31.1) except as modified and supplemented by the requirements set forth herein. All piping shall be supported in such a manner to fulfill the intent of this specification.

2. All piping shall be rigidly supported from the building structure by approved hangers, inserts, or supports. No piping shall be supported from other piping or from metal stairs, ladders, and walkways unless specifically permitted by the Engineer.

3. Where indicated on the Contract Drawings, piping supports shall consist of concrete piers or fabricated steel supports.

4. Each section of the pipe line shall be laid out and all connections made while the pipe is held in temporary supports. After completion of connections the pipe may be clamped in position. When piping is correctly installed, a clamp or pipe connection may be loosed or removed without displacement of the pipe line.

5. Supporting appurtenances shall be arranged to prevent undue stress on equipment to which piping is connected. Supporting appurtenances shall provide the desired pitch as specified or required for proper drainage of the piping. The pipe suspension shall prevent excessive stress, excessive variation in supporting force, and possible resonance with imposed vibration while the system is in operation. All valves and valve operators shall be rigidly supported independently of the piping. Vertical runs of pipe shall be supported independently of the connected horizontal runs. All vertical pipes shall be supported at each floor or at intervals of no more than 10 feet by approved pipe collars, clamps, brackets or wall rests.

6. All piping shall be supported independently of the equipment to which it is connected. All in line devices shall be removable without the need for temporary supports for adjacent and connecting piping.

7. In general, the type of pipe supports to be used for the HVAC hot water system shall be hangers.

8. Wall bracket supports shall be used where shown for pipe to be installed adjacent to a wall. Where it is not feasible to install hanger supports, adjustable pipe saddle supports may be used with the permission of the Engineer. Specifications for the bracket, saddle, and hanger supports are hereinafter given in the Schedule of Pipe Supports.

9. The Contractor shall install pipe supports in conformance with these specifications unless otherwise shown on the Contract Drawings. Where deviations and modifications are required, they shall be made only with the permission of the Engineer. A detailed layout of pipe supports shall be submitted for approval.

10. For all couplings, supports shall be placed on each side and as close to the coupling as possible. Supports shall be of the guide type which prevent axial movement resulting in pipe deflection or misalignment.

11. Structural steel members can be used to support pipe with the approval of the Engineer.

12. Where a specific pipe support is called for on the drawings, this support shall be used as and where indicated for the specific application. In general, spacing of supports shall be as specified herein unless specifically modified by the Engineer.

13. Where inserts or expansion anchors are being installed in concrete slabs, arches, beams, or floors, the insert or anchors shall be placed no closer than 5 inches from the edge.

B. Support Spacing:

1. The distance between supports shall not exceed that listed in the attached schedule.

2. If the pipe to be supported is not listed in the schedule, the next smaller nominal pipe size spacing shall be used. In all cases, there shall be a minimum of one support per laying length of pipe on uninterrupted horizontal runs. This support shall be placed within 1 foot of the joint. If the pipe manufacturer recommends a smaller spacing interval than specified herein, then the manufacturer's spacing shall be used.

3. The distance between supports shall not exceed that listed in the following schedule:

Nominal Pipe Size(in.)	Metallic Piping(ft.)
1/2 inch	5
3/4 up to 1 1/2	6
2 to 3	6

C. Saddles:

1. Type 316 stainless steel pipe saddles shall be used to cradle horizontal piping when being supported from below the spring line except where expansion of pipe requires rollers or slide bearings. All saddles shall be capable of being adjusted after installation. Where space limitation prevents the use of adjustable pipe saddles, concrete pipe saddles shall be cast around the pipe to the spring line. Concrete saddles shall be used to support valves located near the floor that are too bulky to be supported adequately by steel saddles. Paper shall be placed between pipe and concrete to facilitate disassembly of pipe. Concrete saddles and piers shall have 1-inch bevels.

D. Thermal Expansion:

1. Piping subject to thermal expansion, hot water, etc., shall be supported on roller type supports with shields protecting the insulation or pipe slide bearings. Supports adjacent to expansion joints shall be guide type which prevents axial misalignment.

3.03 FLUSHING AND TESTING

A. General:

1. The Contractor shall furnish all necessary labor and equipment required for the field tests specified below including, but not limited to, air compressor, gauges, conduit caps, temporary pipe and connections. The Contractor shall provide water for all flushing and testing, at his own expense, and may use only water from an approved source. The Contractor shall also furnish and install all means and apparatus necessary for getting the water into the pipeline and flushing and testing; including pumps, gages, and meters, any necessary plugs and caps, and any temporary blow off piping required to discharge water, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. All pipelines shall be flushed and tested in such lengths or sections as agreed upon among the Engineer and the Contractor. The Contractor shall give the Engineer reasonable notice of the time when he intends to test portions of the

pipelines. The Engineer reserves the right, within reason, to request flushing and testing of any section or portion of a pipeline.

B. Flushing:

1. At the conclusion of the installation work, the Contractor shall thoroughly clean all new pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. If after this cleaning any obstructions remain, they shall be corrected by the Contractor, at his own expense, to the satisfaction of the Engineer. Pipelines shall be flushed at a rate of at least 2.5 feet per second for a duration suitable to the Engineer.

C. Pressure Testing for Water Piping:

1. After flushing, all pipelines shall be hydrostatically tested. Piping shall be tested at pressures equal to 150 percent of the working pressure specified in the Pipe Schedules, unless a higher Test Pressure is specified.

2. The line shall be filled with water for a period of not less than 6 hours, then subject to the indicated test pressure. During the pressure test, there shall be no leakage. All air shall be purged from the line before pressure testing. The duration of the hydrostatic test shall be 6 hours.

3. The Contractor shall furnish, install complete with reaction blocking, the necessary plugs and caps required for this operation.

4. Any leaks or defective pipe disclosed by the hydrostatic test shall be corrected by the Contractor, at his own expense, and the test repeated until all such piping shows tight.

3.04 DISINFECTION

A. Prior to placing the potable water systems in service, they shall be disinfected in accordance with AWWA Standard C601 and any additional requirements prescribed by the public health authorities having jurisdiction.

B. The form of chlorine for disinfection and the method of chlorine application shall be proposed by the Contractor and approved by the Engineer before the disinfection process is started.

C. The disinfection procedure shall be repeated until satisfactory bacteriological sampling has been achieved.

3.05 PAINTING

A. Piping shall be field painted under this Contract as specified in Specification 09 90 00 – Painting and Coating.

3.06 SPECIAL PROVISIONS AT CONCRETE EXPANSION JOINTS

A. At 3/4 inch or 1-inch concrete expansion joints, all concrete encased pipes shall be provided with a sleeve type coupling. A cavity in the concrete conforming to the detail entitled Buried Expansion Joint shown on the Contract Drawings shall be formed around the sleeve coupling.

3.07 REDUCING BRANCH CONNECTIONS

A. All reducing branch connections shall be made up with tee fittings, saddles, branchlets, or special tapped tee fittings provided with a boss. No pipe wall shall be tapped unless the tap is made with a tapping saddle or sleeve.

3.08 TESTING

A. Shop Tests

The pipe and fittings covered by these specifications shall be tested in accordance with the ASTM, ANSI, and/or AWWA standards specified herein. At least one sample per lot shall be subjected to the standard and optional tests listed in the specifications and their appendices. Copies of the certified test results shall be provided by the manufacturer to the Contractor and submitted in accordance with the Submittals paragraph contained herein.

B. Field Tests

1. Shall be performed as specified herein and in accordance with the General Conditions and Division 01.

C. Witnessed Shop Tests

1. None required.

3.09 PIPE SCHEDULES

A. General

1. The Contractor shall furnish and install all piping, and appurtenances as specified, as shown on the Contract Drawings and including but not limited to the following schedule.

B. Abbreviations and Legends

1. The following abbreviations and legends shall be used in the reading of the schedule:

   a. Service

      HW/S/R Hot Water Supply/Return

   b. Material

      DI - Ductile Iron

      CU - Copper

      STL - Steel

      SS - Stainless Steel

   c. Wall Thickness

      CL - Class

      SCH - Schedule

      PC - Pressure Class

   d. Type of Joint

      FLG - Flanged

      SLD - Soldered

      THD - Threaded

      WLD - Welded

   e. Type of Fittings

      MI - Malleable Iron

      STL - Steel

      BR - Bronze

      SS - Stainless Steel

   f. Protection

      1. Exterior

	PR	-	Primer Applied
	"A" Ins	-	Type A Insulation
	"B" Ins	-	Type B Insulation
	“C” Ins	-	Type C Insulation

2. Interior

ACCL	-	Asphalt Coated Cement Line

C. Schedule

The schedules are presented on the following pages.

INTERIOR AND EXPOSED PIPING

Service	Nominal Pipe Size (Inches)	Material	Wall Thickness	Type of Joint	Type of Fittings	Working Pressure (psig)	Test Pressure (psig)	Protection Interior	Protection Exterior	Remarks
HW S/R	Up to 2-1/2	STL	SCH 40	THD	MI	100	150	--	"A" INS	1-1/2 inch thick INS.

NOTE: Where multiple joint types are indicated (i.e. WLD/FLG), the Contractor shall use welded type except when connecting to valves and equipment where flanged joints are required.

SCHEDULE OF HVAC HOT WATER SYSTEM PIPE SUPPORTS

Diameter of Pipe	Hanger Type	Dia. of Hanger Rod	Type of Anchor	Adjustable Pipe Saddle Supports	Bracket Support
To 2"	Fig. 65	3/8"	Fig. 279	-	Fig. 194
2" up to 4"	Fig. 260	1/2"	Fig. 279	-	Fig. 195

(1) Use multiple hanger rods

(2) Trapeze with chair

Note: All hangers, hanger rods, hanger hardware, and inserts shall be fabricated of 316 stainless steel. Figure numbers shown in this schedule refer to Grinnell Company, Inc. and are used to indicate type and size required. Equivalent models by Basic Engineers, Carpenter Patterson, or approved equal shall be acceptable. Pipe supports attachments, hangers, brackets, guides, restraints and rods or manufactured items shall be of the same base material or compatible based materials as the pipe, i.e. stainless steel 316 or compatible stainless steel if the pipe is of stainless steel material or carbon steel ASTM A139, Grade C or compatible carbon steel if the pipe is of carbon steel material. Concrete inserts shall be of malleable iron with galvanized finish. Bolts, nuts and anchors shall be of type 316 stainless steel. Figure numbers shown in this schedule refer to Grinnell Company, Inc. and are used to indicate type and size required. Equivalent models by Basic Engineers, Carpenter Patterson, or approved equal shall be acceptable.

END OF SECTION

SECTION 23 31 16.16
FIBERGLASS REINFORCED PLASTIC DUCTWORK AND DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install fiberglass reinforced plastic (FRP) ductwork complete with auxiliary equipment and accessories as shown, specified and/or required for proper operation.

1.02 PAYMENT

A. Payment for work furnished and installed under this Section shall be included in the lump sum price for the Contract.

1.03 REFERENCES

A. Reference standards: comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. General requirements of this contract shall supersede the standards in case of conflict:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

2. ASTM D 2996 - Specification for Filament-Wound “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin)

3. ASTM D 3567 - Practice for Determining Dimensions of “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin)

4. ASTM D 3982 - Blowers and Exhaust Systems for Dust, Contact Molded “Fiberglass” (Glass Fiber Reinforced Thermosetting Resin) Duct and Hoods

5. NBS PS 15-69 - Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment

6. SMACNA Thermoset FRP Duct Construction Manual

B. Contractor shall provide certification that all stainless steel accessories including screws, fasteners, hangers, supports, etc. for stainless steel, are Type 316 stainless steel.

C. Contractor shall provide certification that all FRP accessories including supports, hangers, etc. are FRP.

D. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of Division 1. Working drawings and shop drawings shall include, but not limited to:

1. Dimensioned duct layout showing types and locations of supports, hangers, anchors, guides and expansion joints, sealed by a state certified Professional Engineer.

2. Details of construction.

3. Details of installation, hanger details, duct supports, expansion joints and spacing.

4. Manufacturer's literature, illustrations, specifications and Engineering data.

5. Manufacturer’s certification of duct layout, including all elbows, fittings, transitions, etc.

6. Recommended bolting torque values for flanged joints

7. Joint fabrication details

8. Flexible connections.

9. Detailed shipping and installation instructions

10. Visual Inspection Checklist

11. Other technical data related to the specified material and equipment as requested by Engineer.

B. Test Reports: Submit the following test reports for approval where required.

1. Volume Damper leakage tests from an AMCA approved testing laboratory.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the ductwork.

2. Engage a firm which can show successful experience in the fabrication and erection for ductwork systems of scope and type similar to the required Work.

B. Installer Qualifications:

1. Contractor shall have at least 5 years' experience in the installation of the Work specified. He shall employ only tradesmen with specific skills and experience in this type of Work.

2. Contractor shall have undivided responsibility as a single firm for performance and other requirements for the installation of the Work specified herein.

C. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. Underwriters Laboratories, Incorporated (UL)

2. National Fire Protection Association(NFPA).

3. National Electrical Code.

4. Local and State Building Codes and Ordinances:

a. International Building Code.

b. International Fire Code.

5. Permits: Contractor shall obtain and pay for all required permits, fees and inspections.

1.06 WARRANTY

A. FRP ducts shall have a 1-year parts and workmanship warranty. The installing contractor shall be responsible for warranty service and emergency repair during the first 12 months of the system operation. The warranty shall include parts, labor, and travel costs incurred by the manufacturer to provide factory authorized on-site services.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturer: Provide FRP duct as manufactured by one of the following:

1. Composites USA, Dual Guard 2000.

2. Perry Fiberglass Products, Inc.

3. Ershigs/Belco

4. Or approved equal

2.02 FIBERGLASS REINFORCED PLASTIC (FRP) DUCTWORK

A. Service Conditions

1. The FRP ductwork system shall be designed and fabricated for all service to carry warm moisture-laden air with sodium hypochlorite, and other organic and inorganic compounds typically associated with water treatment.

2. The maximum unsupported spans shall be as follows.

Duct Inside Dimension (Inches)	Maximum Span (Feet)
3 – 14	8’
16 and Above	10’

3. Duct wall thickness shall be designed by the Manufacturer to meet the criteria specified in this Section. The minimum wall thickness for all FRP duct shall conform to the following:

Duct Inside Dimension (Inches)	Wall Thickness (Inches)
3 – 16	0.1875
18 – 36	0.250

4. Resin:

   a. Resin shall be premium corrosion resistant and fire retardant brominated bisphenol-A vinyl ester. Resin shall not contain pigments, dyes or colorants. Fillers are only permitted for flame retardance and shall not exceed 5% by weight. The product shall have a Class 1 flame spread rating (25 or less) and smoke developed rating (50 or less) as measured by ASTM E-84 for the exterior and interior. The Engineer reserves the right to request the Contractor to submit laminate samples taken from the job site for confirmation that the specified resin was used throughout the laminate.

b. Thixotropic agents can be added to control resin viscosity per resin manufacturer's recommendation.

c. Acceptable resins with no more than 3 percent antimony trioxide shall be:

1) Reichhold Dion 9300 FR.

2) Interplastics CoRezyn 8440.

3) Ashland Chemical Hetron FR992.

4) AOC Vipel K-022

5. Reinforcement:

a. Surfacing veil shall be C glass veil with a silane finish and a styrene soluble binder.

b. Chopped strand mat shall be Type E glass minimum 1-1/2 ounces per square foot with silane finish and styrene soluble binder.

c. Continuous roving for chopper gun spray up shall be Type E glass. Chopper gun is only permitted if an automated process is used. Manual operation of chopper gun shall not be permitted.

d. Woven roving shall be Type E glass minimum 24 ounces per square yard with a five by four weave.

e. Continuous roving for filament winding shall be Type E glass with a silane finish.

B. Construction

1. All round FRP ductwork shall be of filament wound construction. Square or rectangular FRP ductwork shall be of filament wound or hand lay-up construction.

2. Maximum allowable deflection for any size round ductwork at unsupported span lengths shall be ½ inch under worst case operating conditions, including all service and deadloads.

3. Maximum allowable deflection for any size square or rectangular ductwork at unsupported span lengths shall be 1% of the width of the longest side under worst case operating conditions, including all service loads and deadloads.

4. FRP ductwork shall be designed using a safety factor of 10 for pressure and 5 for vacuum. FRP ductwork shall be designed for a maximum vacuum pressure of 3" w.c. and a maximum positive pressure of 3" w.c.

5. Out of roundness of duct shall be limited to ± ¼ inch for duct sizes greater than 30 inches in diameter.

6. Length of all flanged duct sections shall not vary more than ± ½ inch at 70°F.

7. All unflanged duct shall be square on the ends in relation to the longitudinal axis within ± 1/8 inch up to and including 24-inch diameter and within ± 3/16 inch for all diameters greater than 24 inches.

8. Laminates

    a. All ductwork shall have an internal corrosion barrier consisting of a resin-rich inner surface and a resin rich interior reinforcement layer. The corrosion barrier shall be followed by a structural layer and an exterior layer.

    b. Inner surface: Minimum 20 mils thick composed of a single ply of the Type C glass surfacing veil embedded in a resin rich surface. Resin content shall be 90%.

    c. Interior reinforcement layer: Minimum 100 mils thick composed of at least two layers of chopped strand mat. Resin content shall be 75%.

    d. Structural layer: Type E glass to meet minimum wall thickness as specified. The total wall thickness includes the inner surface and inner layer. The total wall thickness does not include the exterior layer.

        1) Contact molded structural layer shall include alternate layers of chopped strand mat and woven roving.

        2) Filament wound structural layer shall be preceded by a layer of chopped strand mat or spray chop. The structural layer shall consist of a minimum of three complete cross hatched layers of continuous filaments applied in a helix angle of 55 degrees.

    e. Exterior layer: Factory applied paraffinated gel coat with UV inhibitors. Pigmentation shall be determined by the Engineer. Pigmentation shall not be added to the exterior layer until visual inspection has been completed.

f. The duct shall have a Barcol hardness of at least 90 percent of the resin manufacturer's minimum specified hardness for the cured resin when tested in accordance with ASTM D2583.

9. Fittings:

a. All fittings shall be hand-lay up construction fabricated from the same resin and having the same strength as the FRP ductwork.

b. The internal diameter of all fittings shall be equal to the adjacent duct.

c. The tolerance on angles of all fittings shall be ± 1° up to and including 24-inch diameter and ± ½° for 30 inch diameter and above.

d. All branches/takeoffs shall be oversized conical taps or boot taps. Straight taps are not acceptable.

10. Elbows:

a. The centerline radius of all elbows shall be 1-1/2 times the diameter.

b. Elbows smaller than 30-inch diameter shall be smooth radius. Elbows 30 inches and larger shall be mitered. Provide a minimum of three mitered joints for all elbows 30 inches and larger.

11. Flanges:

a. Provide flanged connections to flexible connectors, expansion joints, vessels, demisters, fans, silencers and other locations as shown on the Drawings.

b. Flanges shall be hand lay-up construction, fabricated from the same resin and having the same strength as the FRP ductwork. Dimensions shall be in accordance with NBS PS 15-69 and ASTM D 3982.

c. Flanges shall be drilled in accordance with NBS PS 15-69 Table 2 and ASTM D 3982. Flange faces shall be textured for use with full face gaskets. Backs of bolt holes shall be spot faced for a standard diameter washer.

d. Flange faces shall be perpendicular to the longitudinal axis of the duct within ½ degree.

e. Flange faces shall be flat to within ± 1/32 inch up to and including 18-inch diameter ducts and flat within ± 1/16 inch for 20-inch diameter ducts and larger.

f. Gaskets shall be EPDM, 60 durometers, full face and minimum 1/8-inch thickness.

g. Provide all Type 316 stainless steel bolts, nuts and washers.

12. Joints:

a. Provide all butt and strap joints in accordance with NBS PS 15-69 and ASTM D 3982.

b. Field weld kits shall be supplied by the duct manufacturer. All necessary fiberglass and reinforcing material shall be supplied precut and individually packaged for each joint.

c. All resin, catalyst and putty shall be supplied in bulk to complete all field joints plus 25% extra for waste.

13. There shall be not less than a ¼ inch build-up of FRP over the duct at each duct support.

14. All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled. Structural elements having edges exposed to the chemical environment shall be made with chopped-strand glass reinforcement only.

15. All non-flanged duct shall be cut square with the axis of the duct within 0.13 inch up to and including 24-inch diameter and to within 0.19 inch for all larger diameter duct.

16. The minimum mechanical properties of duct shall be in accordance with the below table.

Contact Molded Properties at 73.4°F	Thickness (inches)			
	1/8 - 3/16	1/4	5/16	3/8 & up
Ultimate tensile strength - minimum (psi)	9,000	12,000	13,500	15,000
Flexural strength - minimum (psi)	16,000	19,000	20,000	22,000
Flexural modulus of elasticity, tangent minimum (psi)	700,000	800,000	900,000	1,000,000
Filament Wound Modulus (Hoop & Axial, Resultant)(psi)	1,100,000	1,600,000	1,700,000	1,700,000

2.03 REGISTERS, GRILLES AND DIFFUSERS

A. Manufacturer: Provide equipment as manufactured by one of the following:

1. AJ Manufacturing Company.

2. Price Industries.

3. Carnes.

4. Tuttle & Bailey.

5. Titus.

6. Or approved equal.

B. General:

1. Units shall be factory-fabricated of Type 316 stainless steel construction and shall distribute the specified of air volume (cubic feet per minute).

2. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70.

3. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers, except linear slot diffusers. Linear slot diffusers shall be provided with round or elliptical balancing dampers.

4. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen according to NFPA 90A.

5. Registers and Grilles:

   a. Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face.

   b. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling.

   c. Grilles shall be as specified for registers, without volume control damper.

6. An additional volume damper shall be installed in duct stub to each air outlet for balancing of air volume.

C. Supply Registers: Supply registers shall be double deflection type, Price Industries Model 720D, or approved equal, complete with adjustable vertical face bars and a key operated opposed blade damper. Air turning devices shall be installed at all collar take-offs to supply registers. Air turning devices shall be Price Industries, or approved equal. The air turning devices shall have two sets of individually adjustable blades to equalize flow and control volume at collar takeoffs and shall be gasketed around the perimeter.

1. Supply registers shall be of Type 316 stainless steel double deflection type complete with opposed blade stainless steel damper.

D. Exhaust and return registers shall be Price Industries Model 730D, or approved equal, complete with fixed vertical face bars, set straight, and a key operated opposed blade damper.

1. Return and exhaust registers and dampers shall be of Type 316 stainless steel with opposed blade stainless steel damper.

2.04 EXPANSION JOINTS

A. Provide expansion joints where shown on the Drawings and as required to avoid damage to the duct or equipment.

B. Type: W-design configuration with integral flanges suitable for service with FRP duct under the conditions specified.

C. Material: EPDM.

D. Backing Rings: 3/8 inch thick, 2 inches wide, Type 316 stainless steel.

E. Extension: 3 inches.

F. Compression: 2.5 inches.

G. Lateral Offset: 2.5 inches.

H. Thickness: ¼ inch, minimum.

I. Bolts, Nuts and Washers: Type 316 stainless steel.

J. Expansion joints shall be manufactured by Holz Rubber Company, General Rubber, The Metraflex Company or Garlock.

2.05 CONTROL DAMPERS

A. Rectangular Fiberglass Reinforced Plastic Dampers

1. FRP fabrication shall meet the corrosion requirements specified in this Section for FRP ductwork and the below requirements:

a. Flame retardant, Series 625 vinyl ester based resin.

b. Pultruded construction.

c. Comply with ASTM D 4385, ASTM E 84, ASTM D 3982 and ANSI/ASME RTP-1.

d. Materials in Airstream: Meet or exceed required contamination concentrations.

e. Exposed Glass: Coat with resin compatible with that used in pultrusion process and covered with surfacing veil.

2. Frame: 8 inches x 2-3/16 inches x minimum 1/4-inch fiberglass channel, vinyl ester resin.

3. Blades:

a. Style: Airfoil-shape.

b. Action: Parallel for 2-position operation, Opposed for modulating operations.

c. Material: Fiberglass, vinyl ester resin.

d. Width: 6-5/8 inches.

e. Skin: Minimum 1/4-inch thick, hollow airfoil shape, full length pultruded axle pocket.

4. Axles: Minimum 3/4-inch diameter fiberglass rod, pultruded construction of vinyl ester based resin, combined with continuous strand roving and complete with surfacing veil.

5. Bearings: Molded PTFE.

6. Linkage: Type 316 stainless steel, side linkage, out of airstream.

7. Seals:

a. Blade: Viton.

b. Jamb: Stainless steel.

c. Axle: Shaft Seals

8. Maximum Temperature: 200 degrees F.

9. Assembly: Factory assemble damper components.

10. Performance Data for Damper Width of 48 inches:

    a. Maximum System Pressure: 12 inches w.g.

    b. Maximum System Velocity: 4,000 feet per minute.

    c. Leakage with Seals: Based on pressure differential of 1-inch w.g.

        1) Leakage: 4 cubic feet per minute/square foot.

11. Performance Data for Damper Width of 12 inches:

    a. Maximum System Pressure: 28 inches w.g.

    b. Maximum System Velocity: 4,000 feet per minute.

    c. Leakage with Seals: Based on pressure differential of 1-inch w.g.

        1) Leakage: 7.5 cubic feet per minute/square foot.

12. Accessories

    a. Bolt Holes: Both flanges.

    b. Actuator: Manual, hand quadrant or electric, see Drawings for details.

13. Quality Control:

    a. Leakage ratings shall be based on AMCA Standard 500 using Test Setup Apparatus Figure 5.3.

14. FRP dampers shall be Model 1108AF as manufactured by Ruskin Swartout, or Belco Manufacturing, or approved equal.

2.06 DUCT HANGERS AND SUPPORTS

A. All hangers and supports for FRP duct shall be spaced as specified in paragraph 2.02 of this Section. Duct spans shall not exceed the duct manufacturer's recommendations or the minimum requirements specified herein.

B. Duct supports located on the exterior of the building shall be designed to include the weight of the duct and to withstand all applicable combinations of wind Loading in accordance with the Contract Documents and any additional local Regulations which are in effect at the time of construction. Exterior supports shall be located as shown on the Drawings and shall be of the "type" shown on the Drawings. The locations of duct supports shown on the Drawings are approximate, and the Contractor shall be required to confirm the support requirements and locations.

C. The Contractor shall note that not all duct support locations are shown on the Drawings, and the Contractor shall follow the Specifications herein in locating Additional supports as required. The Contractor shall be responsible for the Design of supports and for the overall stability of the entire support System. Support and hanger details and a detailed layout showing the location of all duct supports and hangers shall be submitted in the Shop Drawings. The design shall be stamped by a state registered Professional Engineer (Structural).

D. There shall not be less than ¼ inch buildup of FRP over the duct at each saddle support.

E. Duct supports are to be fabricated from fiberglass, including all angles, channels, rods, bolts, etc. All fasteners and anchors are to be 316 SS.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: All FRP duct shall be installed in a neat and workmanlike manner, properly aligned, and cut from measurements taken at the site to avoid interferences with structural members, architectural features, openings and equipment. Exposed ductwork shall afford maximum headroom and access to equipment, and where necessary, all ductwork shall be installed with sufficient slopes (minimum 1/8" per foot, unless otherwise noted on the drawings) for venting or drainage of liquids and condensate to low points. All installations shall be acceptable to the Engineer. It is recommended that the Contractor obtain the assistance of the duct manufacturer's field representative to instruct the duct fitters in the correct installation and support of all FRP duct. The Contractor shall obtain training by the duct manufacturer's field representative in the correct installation and support of all FRP duct. Instruction shall be a minimum of one eight (8) hour day.

B. Supports and Anchors: All ductwork shall be firmly supported with fabricated or commercial hangers or supports. Where necessary to avoid stress on equipment or structural members, the ductwork shall be anchored or harnessed. Expansion joints and guides shall compensate for duct expansion due to temperature differences.

3.02 DUCT JOINTS

A. Adhesive Joints: Adhesive joints shall be made with freshly mixed 2-part epoxy on clean dry duct ends. The joints shall be made up at the recommended ambient temperatures, to the duct manufacturer's written recommendations. All duct ends shall be inserted to the full depth of the socket.

3.03 INSPECTION AND FIELD TESTING

A. Inspection: All finished installations shall be carefully inspected for proper joints and sufficient supports, anchoring, interference, and damage to duct, fittings, and coating. Damage and leaks shall be repaired to the satisfaction of the Engineer.

B. All ductwork shall be leak tested in accordance with SMACNA Air Duct Leakage Test Manual and Section 23 05 93, Testing, Adjusting and Balancing. Duct system shall be sealed to provide a system that is within an allowable leakage limit of 2.5 percent of total air flow at system operating flow and pressure. Duct system shall be balanced to provide capture rates from each take-off point within 2.5 percent of the design air flow at system operating flow and pressure or as stated in the HVAC Specifications. The ductwork test report shall be submitted to the Engineer.

C. If the system is testing in sections, the leakage rates shall be added to define the performance of the whole system.

END OF SECTION

SECTION 23 34 00
FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall provide all labor, materials, equipment and incidentals to furnish and install all fans in accordance with the requirements specified herein as shown on the Contract Drawings or specified in the Specifications.

B. The equipment shall be furnished complete with all accessories, special tools, spare parts, base attachments, mountings, anchor bolts and other appurtenances as specified or as may be required for a satisfactory installation.

C. All fans shall be furnished in accordance with the schedule shown on the Contract Drawings.

1.02 RELATED SPECIFICATIONS

A. Specification 23 05 00 - Vibration and Wind Controls

B. Specification 23 05 80 - Common Motor Requirements for HVAC Equipment

C. Specification 23 05 93 - Testing, Adjusting and Balancing

1.03 PAYMENT

A. Payment for work furnished and installed under this Section shall be as specified in the Specifications.

1.04 REFERENCES

A. Equipment shall comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. American Society of Mechanical Engineers (ASME)
2. American Society of Testing Materials (ASTM)
3. Air Movement and Control Association (AMCA)
4. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
5. National Fire Protection Association (NFPA)
6. National Electric Code (NEC)
7. Applicable Federal, State and local laws and/or ordinances

B. Where conflict arises between the local codes and the requirements of the National Electrical Code, The National Fire Code, NEMA, ASTM, etc., the more stringent requirements shall prevail.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Division 1 of the Specifications, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Preliminary Operation and Maintenance Manuals
3. Final Operation and Maintenance Manuals
4. Spare Parts List
5. Special Tools List
6. Reports of Certified Shop Tests
7. AMCA Approval for Fan Ratings

B. Shop Drawings

1. Shop drawings shall include but not be limited to:

   a. Equipment specifications and data sheets identifying all materials used and methods of fabrication.

   b. Complete assembly, layout, installation and foundation drawings with clearly marked dimensions.

   c. Fan performance curve indicating the operating point.

   d. Details of corrosion resistance coating.

   e. Motor nameplate data as specified in Specification 26.

   f. Detailed specifications and data sheets for all accessories such as roof curbs, dampers, damper operators disconnect switches, vibration isolators etc.

   g. Example equipment nameplate data sheet.

   h. Interconnecting wiring diagrams.

   i. List of recommended lubricants.

C. Operations And Maintenance Manuals

1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Division 1 of the Specifications.
2. Two copies of a preliminary O&M manual shall be included in the shop drawing submittal. Without inclusion of these manuals, the submittal will be considered incomplete and will be returned without review.

D. Lubricants: The manufacturer shall submit a list with a minimum of four (4) manufacturers standard lubricants which may be used interchangeably for each type of lubricant required. The Contractor shall utilize this list in preparing his comprehensive lubrication survey as specified in Division 1 of the Specifications.

1.06 QUALITY ASSURANCE AND QUALIFICATIONS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. It is the intent of these specifications that all components of the fans be provided by the Contractor through one vendor. The Contractor through the vendor shall have the sole responsibility of matching all components and providing equipment which functions together as a system.

1.07 SPARE PARTS AND SUPPLIES

A. Furnish all special tools necessary to dis-assemble, service, repair and adjust the equipment.

B. The following spare parts shall be furnished for up to every four (4) same size of fan:

1. two (2) sets of belts for each belt driven fan

C. Furnish all additional spare parts as recommended by the equipment manufacturers.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

PART 2 - PRODUCTS

2.01 FANS - CONDITION OF SERVICE AND DESIGN DATA

A. Fans shall be as specified below and shown on the Contract Drawings. The Contractor shall include, as part of this work, all supports required. The fans shall be installed where indicated on the Contract Drawings.

B. Performance data for all fans shall be based on tests conducted in accordance with the "Standard Test Code for Centrifugal and Axial Fans" as adopted by the Air Movement and Control Association (AMCA) and shall be licensed to bear the AMCA certified rating seal for both sound and air performance. All fans shall be selected from performance curves and not from rating tables. A copy of the curve, indicating the operating point, shall be submitted for each proposed fan.

C. Unless otherwise indicated, motors shall be of the totally enclosed premium efficiency type. Motors shall not be selected for operation in the service factor range/zone. The maximum brake horsepower required at any point on the performance curve shall not exceed the rated horsepower of the motor.

D. Motors 1/3 HP and less shall be suitable for use with 115V, single phase, 60 Hz electric service. Motors 1/2 HP or larger shall be for use with 460V, three phase, 60 Hz electric service, unless otherwise indicated. Two speed motors shall be two winding type.

E. All fans and damper operators shall each be provided with individual externally mounted disconnect switches. All enclosures shall be NEMA 4X stainless steel unless otherwise specified.

F. All dampers for roof mounted fans shall be mounted in the mounting pedestal with removable access panel for inspection and servicing of damper and operator. Mounting pedestal shall provide solid ventilator support and a weather tight seal.

G. All fans shall be statically and dynamically balanced at the speed at which the unit is scheduled to operate. Fans with corrosion resistant coatings shall be balanced after being coated.

H. The fans shall be either direct connected or V belt drive as indicated on the schedule. For motors less than or equal to 10 HP, the V belt drive shall be selected for 120 percent of rated capacity. For motors larger than 10 HP, the V belt drive shall be selected for 150 percent of rated capacity. All V belt drives shall be provided with adjustable sheaves. Exposed V-belt drives shall have removable belt guards with openings to allow for tachometer readings at both drive and fan shafts. Guards shall be so constructed as to allow visual inspection of the belts without removing the guard.

I. Vibration isolators shall be provided in conformance with Specification 15050. Isolators shall have a minimum efficiency of 90 percent. Installation, type, number, and size of isolators shall be in conformance with the manufacturer's recommendations for the frequencies involved.

J. All fan bearings shall be selected for a minimum L-50 life of 100,000 hours at maximum operating speed.

K. All fans shall be provided (inside and outside) with baked on Heresite corrosion resistant coating including all accessories but not limited to the housing, wheels, curbs, liners, dampers, damper access sections.

L. All shafts shall be sized so the first critical speed is at least 20 percent over the maximum operating speed. Close tolerance shall be maintained along the length of the shaft.

M. Each fan shall bear a permanently affixed manufacturer’s nameplate containing the model number and individual serial number for future identification.

N. Fan manufacturer shall provide sound power ratings in the eight octave bands. Sound power levels shall be based on AMCA Standard 301. Sound power ratings shall be in decibels, referenced to 10-12 watts.

O. All dampers shall be of the low leakage type complete with 316 stainless steel channel frame, blades and baffles, inflatable fabric reinforced neoprene rubber blade edge seal,

spring loaded side seals, and, where required, extended axles. Parallel blade action shall be provided for two position applications. Dampers shall be certified that leakage does not exceed 10 CFM per square foot with 2 inches of static pressure across damper. Dampers shall have stainless steel pins and nylon bushing.

2.02 IN-LINE CABINET FANS

A. In-line square fans shall be of the centrifugal belt driven or directly driven in-line type, as indicated on the fan schedule. The fan housing shall be of the square design constructed of minimum 18 gauge galvanized steel with integral duct mounting collars.

B. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.

C. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

D. Motors and drives shall be mounted out of the airstream with combination motor cover and belt guards. Motors shall be readily accessible for maintenance.

E. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings.

F. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for system balancing.

G. Fans shall be Model BSQ/SQ as manufactured by Greenheck of Schofield, Wisconsin, or approved equal.

2.03 WALL MOUNTED CENTRIFUGAL EXHAUST FAN

A. Sidewall exhaust fans shall be upblast centrifugal belt driven or direct drive type, as indicated on the fan schedule. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength and shall have steel mounting plate and integral venturi attached.

B. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

C. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

D. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be externally mounted within NEMA 4X stainless enclosures. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.

E. Fans shall be provided with the following:

1. Aluminum birdscreen.

2. Motor operated low leakage damper

3. Heat baffle with 1" thick insulation shield

4. Aluminum louvered wall grille

F. Fans shall be Model CUE/CUBE manufactured by Greenheck of Schofield, Wisconsin, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The fans shall be installed, connected and placed in proper working order in accordance with the manufacturer's instructions and details, and the Contract Drawings.

3.02 IDENTIFICATION

A. Each unit of equipment shall be identified with the equipment item numbers given on the Contract Drawings, the Specifications or as directed by the Engineer. A corrosion resistant tag or nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer's name or trademark and such other information as the manufacturer may consider necessary, or as specified, for complete identification.

3.03 TESTING

A. All tests shall be performed in accordance with the requirements of Division 1 of the Specifications.

B. Motor tests in accordance with Specification 26 15 00, Electrical Motors.

C. Field tests shall be performed in accordance with Specification 23 05 93, Testing, Adjusting and Balancing and Division 1 of the Specifications.

3.04 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment

furnished under this Contract. The services of the manufacturer's representative shall be provided for a period of not less than 2 days as follows:

1. One trip of 1 day during installation of the equipment.

2. One trip of 1 day for startup and training.

B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out each day he is at the project. Travel time to and from the Site shall not be included in measuring the above visits. Only time spent on the Site shall be counted.

C. Training

1. The Contractor shall provide training for Building personnel in accordance with Division 1 - General Requirements.

2. The Contractor shall include in his request for manufacturer approval a certification that the manufacturer has been advised of the requirements of Division 1 - General Requirements, and that the costs associated with said training submittals and training have been included in the manufacturer's pricing.

D. Lubricants

1. The manufacturer shall submit a list with a minimum of four manufacturer’s standard lubricants which may be used interchangeably for each type of lubricant required.

2. The Contractor shall utilize this list in preparing his comprehensive lubrication survey as specified in Division 1.

E. The manufacturer's time for training as specified by Division 1 and as specified herein shall not be included under this paragraph.

END OF SECTION

SECTION 23 73 80
PACKAGED AC UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall provide all labor, materials, equipment and incidentals to furnish and install all Units with the requirements specified herein and as shown on the Contract Drawings or specified in the Specifications.

B. Each system shall be furnished complete with an indoor evaporator/air conditioning unit, an outdoor air cooled condenser unit, refrigerant piping, insulations, control wiring and all accessories, special tools, spare parts, base attachments, mountings, anchor bolts and other appurtenances as specified or as may be required for a satisfactory installation.

1.02 RELATED SPECIFICATIONS

A. Specification 23 05 00 - Vibration, and Wind Controls

B. Specification 23 05 53 - Identification for HVAC Piping and Equipment

C. Specification 23 05 93 - Testing, Adjusting and Balancing

1.03 PAYMENT

A. Payment for work furnished and installed under this Section shall be as specified in the Specification.

1.04 REFERENCES

A. Equipment shall comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. American Society of Mechanical Engineers (ASME)

2. American Society of Testing and Materials (ASTM)

3. Air Conditioning and Refrigeration Institute (ACRI)

4. National Fire Protection Association (NFPA)

5. National Electrical Code (NEC)

6. Applicable Federal, State and local laws and/or ordinances

B. Where conflict arises between the local codes and the requirements of the National Electrical Code, The National Fire Code, NEMA, ASTM, etc., the more stringent requirements shall prevail.

1.05 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Division 1 of the Specifications the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Preliminary Operation and Maintenance Manuals

3. Final Operation and Maintenance Manuals

4. Spare Parts List

5. Special Tools List

6. Reports of Certified Shop Tests

B. Each submittal shall be identified as specified in Division 1 of the Specifications.

C. Shop Drawings:

1. Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed piping material's compliance with the Contract Documents. Partial or incomplete submissions shall be returned to the Contractor disapproved without review.

2. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmittal.

3. Shop drawings shall include but not be limited to:

   a. Equipment specifications and data sheets identifying all materials used and methods of fabrication.

   b. Complete assembly, layout, installation drawings with clearly marked dimensions.

c. Interconnecting wiring diagram.

d. Example equipment nameplate data sheet.

D. Operations and Maintenance Manuals

1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Division 1 of the Specifications.

2. Two copies of a preliminary O&M manual shall be included in the shop drawing submittal. Without inclusion of these manuals, the submittal will be considered incomplete and will be returned without review.

1.06 QUALITY ASSURANCE AND QUALIFICATIONS

A. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. In conformance with Division 1 of the Specifications, equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and as shown on the Contract Drawings.

B. Names of manufacturers, subcontractors, and dealers shall be submitted for approval in accordance with Division 1 of the Specifications.

C. Refrigeration equipment shall be listed and labeled to UL 1995-2005. UL listing shall be indicated on the Shop Drawings.

D. Refrigeration system shall be constructed in accordance with ASHRAE 15-2010: Safety Standard for Refrigeration Systems and ASHRAE 34-2010.

1.07 SPARE PARTS AND SUPPLIES

A. Furnish all special tools necessary to dissemble, service, repair and adjust the equipment.

B. The following spare parts shall be furnished with each unit:

1. Two (2) sets of Filters

C. Furnish additional spare parts as recommended by the equipment manufacturers.

D. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.08 WARRANTY

A. Unit shall have a 2-year parts warranty and the compressors shall be covered by an additional 3-year warranty. The installing contractor shall be responsible for warranty service and emergency repair during the first 24 months of the system operation. The warranty shall include parts, labor, and travel costs incurred by the manufacturer to provide factory authorized on-site services. Equipment submittals will not be approved until submission of the manufacturer's warranty indicating compliance with the above.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers:

1. Bard HVAC
2. Marvair
3. Airxcel
4. Solair HVAC
5. Or approved equal

2.02 WALL MOUNTED PACKAGED AC UNIT SYSTEM

A. Non-Fiberglass Foil Faced Insulation: High "R" value non-fiberglass insulation used with a FSK foil face.

B. Lockable hinged access cover to circuit protection. Phase rotation monitor is 3 phase models. Adjustable compressor on/off delay timer (CCM) with diagnostic lights Electrical entrances provided through the back and side areas.

C. Green Fin Hydrophilic Evaporator Coil to prevent mold growth, aids with condensate drainage, and provides a limited amount of protection to corrosive particulates in the airstream.

D. ECM Indoor Motor: 5 speed dual shaft motor provides quiet airflow operation when used with a twin blower assembly with motor overload protection.

E. Enclosed Condenser Motor: An enclosed casing condenser motor with ball bearings.

F. High Efficiency Cooling: Scroll compressors for quiet, efficient cooling. Designed with R-410A (HFC) non-ozone depleting refrigerant in compliance with the 2010 EPA requirements. Unit is provided with a liquid line filter-drier.

G. Filter: 2” disposable pleated MERV13 filter. Filter replacement in 3-month or less intervals is recommended for the best filter and unit performance.

H. Cabinet shall have a stainless steel finish.

I. Fan blades shall have a corrosion resistant coating.

J. Unit shall have a Corrosion Resistance Coated Evaporator and Condenser Coil, Interior/Exterior Unit Coating.

K. Provide all necessary hardware to mount unit to wall. All hardware shall be 316 stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Units shall be installed, connected and placed in satisfactory working order in accordance with the manufacturer's instructions and details, and the Contract Drawings. The Contractor shall furnish and install interconnecting wiring and conduits between the field mounted devices and the unit.

B. Install unit with wall bracket supplied by the manufacturer, with all the clearances required as shown on the Drawings.

C. Install all other accessories as required by the manufacturers and indicated on the Drawings.

D. Clearances shall be maintained around all components so as to permit inspection, servicing, repair, replacement and visibility of all appurtenances. When units are installed or replaced, clearance shall be provided to allow access for inspection, maintenance and repair. Passageways around all sides of the units shall have an unobstructed width as required by the manufacturer.

3.02 CONTROL SEQUENCE FOR UNIT

A. Cooling

1. If power to unit has been off for an extended period of time, crankcase heater shall be energized at least 24 hours prior to starting compressor.

2. The indoor fans, outdoor fans and compressor shall start immediately upon command from the controlling thermostat or the remote microprocessor control in either the cooling or the heating mode of operation. In a system with a one stage thermostat, the unit shall be wired so the compressor starts fully loaded.

3.03 IDENTIFICATION

A. Each unit of equipment shall be identified with the equipment item numbers given on the Contract Drawings and in Division 1 of the Specifications. A corrosion resistant tag and nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer's name or trademark and such other information as the manufacturer may consider necessary, or as specified, to complete identification.

3.04 TESTING

A. All tests shall be performed in accordance with the requirements of Division 1 of the Specifications.

B. Field tests shall be performed in accordance with Specification 23 05 93, Testing, Adjusting and Balancing and Division 1 of the Specifications.

3.05 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment furnished under this Contract. The services of the manufacturer's representative shall be provided for a period of not less than 3 days as follows:

1. One trip of 1 day during installation of the equipment.

2. One trip of 1 day for startup and training.

B. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out each day he is at the project. Travel time to and from the Site shall not be included in measuring the above visits. Only time spent on the Site shall be counted. One day is 8 hours exclusive of travel and lodging time.

C. Training

1. The Contractor shall provide training for Building personnel in accordance with Division 1 - General Requirements.

2. The Contractor shall include in his request for manufacturer approval a certification that the manufacturer has been advised of the requirements of Division 1 - General Requirements, and that the costs associated with said training submittals and training have been included in the manufacturer's pricing.

D. Lubricants

1. The manufacturer shall submit a list with a minimum of four manufacturer’s standard lubricants which may be used interchangeably for each type of lubricant required.

2. The Contractor shall utilize this list in preparing his comprehensive lubrication survey as specified in Division 1.

E. The manufacturer's time for training as specified by Division 1 and as specified herein shall not be included under this paragraph.

END OF SECTION

SECTION 23 76 20
HEATERS, ELECTRIC

PART 1 - GENERAL

1.01 RELATED SPECIFICATIONS

A. Specification 23 05 93 – Testing, Adjusting and Balancing

1.02 PAYMENT

A. Payment for work furnished and installed under this Section shall be as specified in the Specifications.

1.03 REFERENCES

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. General requirements of this Contract shall supersede the Standards in case of conflict:

1. Air Moving and Conditioning Association (AMCA)
2. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
3. National Electrical Manufacturers' Association (NEMA)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of Division 1 of the Specifications.

B. Shop Drawings: Submit for approval the following:

1. Dimensions.
2. Capacities.
3. Materials of construction.
4. Finishes, standard and custom color chart for Engineer's approval.
5. Manufacturer's literature, illustrations, Specifications and engineering data.
6. Documentation from the factory substantiating painting systems in accordance the specifications. Include types applied and dry film thicknesses.

C. Operations and Maintenance Manuals:

1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Division 1, General Requirements of the Specifications.

2. Two copies of a preliminary O&M manual shall be included in the shop drawing submittal. Without inclusion of these manuals, the submittal will be considered incomplete and will be returned without review.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single firm, with undivided responsibility for performance, fabrication, and other requirements.

2. The equipment covered by these specifications is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. Contractor's Qualifications:

1. Contractor shall have at least 5 years' experience in the installation of the Work specified. He shall employ only tradesmen with specific skills and experience in this type of Work.

2. Contractor shall have undivided responsibility as a single firm for performance and other requirements for the installation of equipment specified herein.

C. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. Underwriters Laboratories, Incorporated (UL).

2. National Fire Protection Association (NFPA).

3. National Electrical Code (NEC).

4. Local and State Building Codes and Ordinances.

   a. International Building Code.

   b. International Fire Prevention and Building Code.

   c. International Energy Conservation Code.

PART 2 - PRODUCTS

2.01 ELECTRIC DUCT HEATERS (EDH)

A. Product and Manufacturers: Provide completely factory assembled and wired units as made by one of the following:

1. Indeeco.

2. Electroduct, Brasch Manufacturing Company.

3. Or approved equal.

B. Capacity and electrical supply characteristics shall be as scheduled on Drawings.

C. Construction:

1. Framing for duct heater shall be flanged for internally insulated duct, slip-in type if external insulation is used.

2. Duct heater frame shall be reinforced with needed corner bracing.

3. Insulation of fiberglass at least 1/2 inch thick shall be used between duct heater and control box for maximum condensation protection.

4. Heaters shall be constructed per U.L. standards for zero clearance and shall meet NEC requirements.

5. Heating elements shall be finned tubular Type 301 or 304 stainless steel with internal resistance wire of 80% nickel and 20% chromium; steps shall be arranged to prevent stratification when operating at less than full capacity.

6. Provide insulated element terminals.

7. Frame shall be constructed of minimum 16 heavy gauge stainless steel with stainless steel brackets, stiffening ribs and gussets spot welded to the casting.

8. Terminal box shall be spot welded construction with solid, hinged cover, totally enclosed, without louvers or grilles per UL Standard 1096. NEMA 4X stainless steel.

9. Three phase heaters shall be furnished with balanced phases on each step.

10. Elements shall be rated approximately 50 watts per square inch of wire surface area.

11. Air flow sensing tube for air flow proving switch shall indicate direction of air flow and be field reversible without removing heater from duct.

12. Disc type automatic reset thermal protection shall be provided as the primary protection and shall be mounted on the duct heater directly in the air stream to provide positive, fast response.

13. Provide secondary manual limit-type reset thermal protection in control circuit in series with automatic.

14. Heaters shall be electrically tested at 1,000 volts if rated at 250 volts or less and 1,000 volts plus twice the rated voltage if rated at more than 250 volts.

15. All heaters shall be tested at manufacturing facilities for assurance of high quality standards and performance by trained personnel. All components shall be tested for function following installation in the heater.

16. Wiring Diagrams: A wiring diagram shall be furnished for each type of heater. Diagram shall include recommended supply wire gauges in conformance to the NEC and fuse sizes. Typical wiring diagrams are not acceptable.

D. Duct Size: Shall be as scheduled on Drawings.

E. Step Controller (3 or more heating stages as scheduled):

1. Type: Electronic.

2. Steps: Shall be as scheduled on Drawings.

3. Input: 0 to 135 ohm.

4. Step controller shall cycle to 0 load if a momentary power interruption occurs.

F. Pilot Lights: Built in, factory wired, transformer coupled, 6-volt lamped pilot lights shall indicate the following conditions:

1. Heater Energized.

2. Step Energized: 1 per step.

3. When built in air flow switch opened.

G. Proof of Air Flow Switch:

1. In accordance with UL Standard 1096.

2. Type: Pressure differential switch.

3. Shall deactivate unit and de-energize heating element if proper air flow is not present.

H. Built in Options:

1. Mercury Control Contactors.

2. Main Power Disconnect Switch.

3. Interlock terminal strip for interlocking supply air fan.

4. Control Transformers with Fused Primaries for 120 VAC and 24 VAC circuits.

5. Solid state variable power control.

I. Unit Mounted Control Enclosure: Standard control box shall be of the hinged, solid cover type, NEMA 4X stainless steel construction.

2.02 ELECTRIC UNIT HEATERS-CORROSION RESISTANT TYPE

A. Electric unit heaters shall be, INDEECO, Model TRIAD, Trane Co. Model UHRA, Chromalox Model LUH, or approved equal Fan Forced Heaters. The unit heaters shall be complete with casing, element, fan, motor fan guard and factory-wired controls. The unit shall be listed by Underwriters' Laboratories.

B. Corrosion Resistant Unit Heater:

1. Description:

a. Minimum 16 gauge 304 stainless steel.

b. UL listed for wall or ceiling mounting.

c. Stainless steel swivel wall mounting bracket.

d. Chrome plated monel fin tube heating elements attached to junction box with leak proof threaded fittings. All sheetmetal parts protected by zinc chromate primer and 2 coats of epoxy enamel, all factory painted.

e. Integral NEMA 4X molded fiberglass junction box for all unit mounted controls, as listed below.

2. Motor:

a. UL listed.

b. Totally enclosed with permanently lubricated ball bearings.

c. Thermal overload protection built-in. Moisture and corrosion resistant automatic reset.

3. Fan:

a. Aluminum spark resistant construction.

b. Painted with one coat zinc chromate primer and two coats corrosion resistant epoxy paint.

4. Adjustable louvered outlet grille, 304 stainless steel.

5. Heavy gauge rear wire grille, chrome plated.

6. All hardware shall be stainless steel.

7. Controls: Heating elements, motor and cutout to be factory prewired to junction terminal block for easy hook-up. Furnish all controls (thermostat, relay, transformer etc.) for field installation as necessary for control operation.

8. Built-in:

   a. Two power contactors, primary and backup.

   b. Motor contactor.

   c. Over temperature protection.

   d. Thermal fan delay switch.

   e. Pilot light (Power on).

   f. 3-position switch (Heat-Off-Fan).

   g. NEMA 4X disconnect switch.

   h. Provide transformer for factory control circuit.

9. Room Thermostat: Field Installed:

   a. Wall mounted corrosion resistant thermostat.

   b. Heavy duty line voltage SPDT, 120V, single phase.

   c. Range: 40° to 100°F.

   d. UL listed.

   e. Weatherproof NEMA 4X.

   f. Shielded sensing bulb.

   g. Neoprene gasket to seal out dust and moisture.

   h. Adjustable knob for temperature setting.

   i. Positive off by setting unit to low position.

   j. Peco Model TF115-001A or approved equal.

2.03 ELECTRIC UNIT HEATERS-NON-CORROSIVE RESISTANT TYPE

A. Unit heater based on Indeeco, model UCI or approved equal.

B. Heating Elements – Industrial grade stainless steel tubular elements in 2-10 KW units.

C. Housing – Cabinet is constructed of 18 and 20-gauge galvanized steel finished with durable almond polyester powder paint.

D. Outlet Grille – The outlet grille has individually adjustable louvers to direct airflow. Provide a protective outlet mesh screen.

E. Fan Motor – Totally enclosed, thermally protected motor with factory-lubricated ball bearings operates at 58 dBA (2-10 kW). Blow-through design reduces motor operating temperature for longer life.

F. Built-in Controls – Include 240/208 volt control circuit (with transformer if necessary), automatic reset thermal cutout, fan override and factory-installed contactor. Power fusing is supplied for heaters over 48 amps.

G. Mounting Bracket – Wall and ceiling bracket provided with each unit under 40 KW for horizontal mounting.

H. Provide unit with line voltage thermostat.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect units for damage prior to installation and correct as necessary.

3.02 INSTALLATION

A. Unit heaters shall be installed, connected and placed in satisfactory working order in accordance with the manufacturer's instructions and details, and the Contract Drawings.

B. Each unit of equipment shall be identified with the equipment item numbers given on the Contract Drawings and in Division 1. A corrosion resistant tag or nameplate, securely affixed in a conspicuous place on each unit shall give the equipment item number, manufacturer's name or trademark and such other information as the manufacturer may consider necessary, or as specified, to complete identification.

C. Install units in accordance with details on the Drawings and approved Shop Drawings.

D. Coordinate with ceiling grid for ceiling recessed units installation.

3.03 PAINTING

A. All exterior and interior metal surfaces of unit heaters except coils, shall be factory primed and factory painted in accordance with Specification 09 90 00, Painting.

3.04 CLEANING

A. Clean tar, cement or other dirt from units.

B. Remove debris and other waste material resulting from installation.

3.05 ADJUSTMENTS

A. Conform to requirements of Specification 23 05 93

B. Set air deflectors for proper air delivery.

C. Check room thermostat and wiring connections to heater.

END OF SECTION

SECTION 23 81 50
DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all duct insulation complete with auxiliary equipment and accessories as shown, specified and/or required for proper operation.

1.02 RELATED SPECIFICATIONS

A. Specification 23 05 53 – Identification for HVAC Piping and Equipment

B. Specification 23 81 00 – Ductwork and Duct Accessories

1.03 PAYMENT

A. Payment for work furnished and installed under this Section shall be as specified in the Detailed Specification.

1.04 REFERENCES

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. General Requirements of this Contract shall supersede the Standards in case of conflict:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

2. ASTM E 84 - Surface Burning Characteristics of Building Materials

3. NFPA 255 - Surface Burning Characteristics of Building Materials

4. UL 723 - Test for Surface Burning Characteristics of Building Materials

5. NFPA 90A - Installation of Air Conditioning and Ventilating Systems

6. ASTM C 449 - Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

7.	ASTM C 534	-	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
8.	ASTM C 547	-	Mineral Fiber Pipe Insulation
9.	ASTM C 552	-	Cellular Glass Thermal Insulation
10.	ASTM C 553	-	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
11.	ASTM C 612	-	Mineral Fiber Block and Board Thermal Insulation
12.	ASTM C 647	-	Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
13.	ASTM C 916	-	Adhesives for Duct Thermal Insulation
14.	ASTM C 920	-	Elastomeric Joint Sealants
15.	ASTM C 1126	-	Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

B. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the Division 1 - General Requirements of the Specifications.

B. Shop Drawings: Submit for approval manufacturer's catalog literature, specifications and illustrations with the following information:

1. Thermal properties
2. Physical properties
3. Fire hazard ratings
4. Facing information
5. Installation instructions

6. Jointing recommendations for butt joints and longitudinal seams

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the duct insulation installation.

2. Engage a firm which can show successful experience in the manufacture of duct insulation systems of scope and type similar to the required Work.

B. Contractor's Qualifications:

1. Contractor shall have at least 5 years' experience in the installation of the Work specified. He shall employ only tradesmen with specific skills and experience in this type of Work.

2. Contractor shall have undivided responsibility as a single firm for performance and other requirements for the installation of the Work specified herein.

C. Requirements of Regulatory Agencies: Comply with applicable provisions of regulatory agencies below and others having jurisdiction.

1. Underwriters Laboratories, Incorporated (UL).

2. National Fire Protection Association (NFPA).

3. Local and State Building Codes and Ordinances.

a. International Building Code

b. International Fire Code

c. International Energy Conservation Code

D. General: Insulation systems including covering, mastics, adhesives, sealers and facings shall have the following Fire Hazard Classifications in accordance with ASTM E 84:

1. Flame spread, 25 maximum.

2. Fuel contributed, 50 maximum.

3. Smoke developed, 50 maximum.

E. Source Quality Control: Perform the following tests and inspections at factory.

1. Flame Spread

2. Smoke Developed

3. Fuel Contributed

F. Manufacturer's Markings:

1. Stamp or label with manufacturer's name and brand every package or standard container of covering, adhesive and coating delivered to the job site for use.

2. Exposed side of insulation shall be legibly labeled by the manufacturer to show thickness, type and manufacturer.

1.07 JOB CONDITIONS

A. Sequencing: Obtain the Engineer's approval of insulation, adhesives, coatings and method of installation before installing any insulation.

B. All duct leaks shall be sealed prior to installation of external insulation to prevent billowing and damage to insulation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturer: Provide insulation of one of the following:

1. Owens Corning.

2. CertainTeed Corporation.

3. Schuller International, Inc. (Johns-Manville).

4. Or approved equal.

B. Exposed Ductwork Insulation (Rigid): All exposed ductwork as listed under Paragraph 3.06 - Schedules, shall be insulated with minimum 1-1/2" thick (except 2 inches thick for ducts located outdoor and outside air intake plenums) glass fiber board having a density of not less than 3.0 lbs./cu.ft., and a thermal conductivity of not more than 0.23 BTU-inch/hour square feet °F at 75°F mean temperature. The insulation shall be Johns-Manville No. 814 Spin - Glas, Certain Teed Corporation Industrial Board, or approved equal. The insulation shall be

impaled over pins welded to the duct surface on 12" centers. The pins shall be coated with vapor barrier adhesive, and the insulation shall then be secured with caps over the pins. All joints and breaks in the vapor barrier shall be sealed with 3" wide strips of the vapor barrier facing. All insulation shall be reinforced with corner bead. The facing shall be finished with a 3-ply application of lagging adhesive, glass fabric reinforcing and a finish coat of mastic.

C. Adhesives and Accessories:

1. Mineral Fiber Insulation Cement: Cement shall be in accordance with ASTM C 195.

2. Lagging Adhesive: Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with ASTM E 84.

3. Contact Adhesive: Adhesive may be dispersed in a non-halogenated organic solvent with a low flash point (flash pint less than minus 25°F when tested in accordance with ASM D 3278) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200°F. The adhesive shall be nonflammable and fire resistant.

4. Caulking: Caulking shall be in accordance with ASTM C 920.

5. Corner Angles: Nominal 0.016 inch type 316 stainless steel 1 x 1 inch with factory applied kraft backing and adhesive.

6. Finishing Cement: Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.

7. Fibrous Glass Cloth and Glass Tape: Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84.

8. Staples shall be outward clinching Type 316 stainless steel.

9. White Vapor Retarder ASJ (All Service Jacket): For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting.

PART 3 - EXECUTION

3.01 INSPECTION

A. Ensure that all surfaces are clean and dry before applying insulation.

3.02 PREPARATION

A. Ensure that ductwork has been inspected and released for application of insulation.

3.03 INSTALLATION

A. Install insulation so as to make surfaces smooth, even and substantially flush with adjacent duct insulation.

B. Follow manufacturer's application instructions for all materials used.

C. Duct sizes indicated on Drawings are clear inside dimensions. Increase duct sizes to give designated inside dimensions when internal insulation is used.

D. Thickness of rigid insulation shall be greater than the seams or angles of ductwork to which it is applied.

E. Duct insulation shall be continuous through sleeves and prepared openings.

F. Insulation shall terminate at fire dampers and flexible connections.

G. Vapor barrier materials shall be applied to form a complete unbroken vapor seal over insulation.

H. Provide Type 316 stainless steel jacketing and waterproof sealants for insulated ducts exposed to outdoor.

I. Field Painting shall comply with the requirements of Specification 09 90 00, Painting and Coating.

J. Identification markers and labels shall be in conformance with Specification 23 05 53.

3.04 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

B. Seal penetrations with flashing sealant.

C. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

D. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

E. Seal jacket to wall flashing with flashing sealant.

3.05 CLEANING

A. Remove all debris, waste materials and loose foreign matter resulting from installation.

3.06 SCHEDULES

A. Thermal Insulation - Rigid: The following exposed ductwork exposed in room shall be insulated:

1. All indoor supply and return ductwork associated that serves and air conditioned units.

2. Where indicated on the Contract Drawings.

3. All outdoor air plenums.

4. All outside air duct up to the electric duct coil.

B. Insulation Thickness: All ductwork insulation shall be 1-1/2 inch thick (R-6) except for outside air intake plenum and outside air ductwork insulation which shall be 2 inches thick (R-8).

END OF SECTION

SECTION 23 91 00
HVAC INSTRUMENTATION AND CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall, through the services of the controls supplier, furnish, install, test and place in operation, HVAC process instrumentation and control devices, as detailed herein and as shown on the Contract Drawings. The instruments and controls shall be top quality, standard offerings of a nationally recognized manufacturer. When available, instruments and/or control devices shall be procured from a single manufacturer. The equipment shall be installed in accordance with the Specifications, manufacturer's recommendations and best industry practice. Instruments and controls shall be installed complete with all process connections, supports, mounting brackets and hardware, conduit and wiring, terminations, etc. to provide a complete and properly functioning installation.

B. The Contractor shall provide all necessary process taps, isolation valves, nipples, penetrations, instrumentation supports, etc. required to provide a complete and operational installation. Conduits, raceways, wiring, junctions for control and signal wiring shown on Electrical Drawings are provided therein. All additional conduit required for a complete installation shall be provided under this specification section.

C. Taps and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. It is the Contractor's responsibility to ensure that the sizing, location, orientation and dimensions of instruments and the connections and taps for instrumentation furnished under this Division are such as to provide the required accuracy of measurement, the proper bracing, protection of the sensor from accidental damage and accessibility for maintenance.

D. It shall be the responsibility of the controls supplier to provide instruments that have been properly sized and applied to the process in which they are to be used. The controls supplier shall calculate the proper size, range, material, location, orientation and set point for all instruments provided under his Contract to give the most accurate readings in the appropriate ranges. Calculations shall be submitted with the instrument for approval. Unless otherwise noted, instruments shall be selected so that the expected nominal operating range is within the middle 1/3 of the instrument's scale.

E. As part of his testing, the Contractor shall assume the responsibility of testing of all electrical work associated with this system.

F. Instruments and controls shall be correctly interfaced to the system and equipment to which they are associated and connected. Mounting brackets and/or stands, hardware, anchors and appurtenances shall be furnished and installed as required.

G. Instruments shall be installed in logical groups associated with a specific piece of equipment or system and shall be readable from a central location near the associated equipment. Instruments shall be oriented so as to be easily readable from the floor.

1.02 RELATED SPECIFICATIONS

A. All work of this Division shall meet the requirements of the following related Sections and Divisions.

1. Division 1
2. Division 23
3. Division 26 – Electrical.

1.03 SUBMITTALS

A. The Contractor shall submit working drawings, shop drawings and material specifications for all equipment and work provided, for the approval of the Engineer in accordance with the requirements of Division 1 and 23.

B. Submit the following items for review and approval by the Engineer:

1. Completed ISA S20 data sheets, installation and instruction manuals, operation and maintenance manuals, for each and all items provided under this Section, for review and approval. Each item's data sheet shall have a complete listing of tag numbers to which that data pertains.
2. Manufacturer's installation, operation and maintenance manuals.
3. Software, manuals and configuration data for all units requiring programming and/or configuration.
4. Drawings and descriptions of supports, mounting details and process connections and taps for all instruments.
5. Calculations, assumptions and manufacturers recommended installation requirements indicating the methods used in proper sizing, location and orientation of all instruments.
6. Submit for review and approval, instrument installation layout drawings showing proposed locations of all instruments and equipment. The drawing shall be done to scale and dimensioned on a background of equipment and piping.

1.04 SPARE PARTS AND SPECIAL TOOLS

A. The Contractor shall provide spare parts and special tools for all equipment supplied, in accordance with Division 1. The specifications and as detailed herein. Deliver all spare parts, tools and supplies with the equipment, neatly wrapped and boxed, indexed and tagged with complete information on their use and reordering.

B. Provide all of the individual manufacturers recommended spare parts and tools for all equipment specified herein. In addition to the recommended spares, furnish all of the following minimum spare parts, tools and devices. Spare parts and special tools shall be provided in accordance with the requirements of Division 1.

1. General

a. Provide 10% (minimum of 10) spare fuses, indicating lights, etc., for each size and type provided.

2. Electronic Field Instruments

a. Provide 1 complete spare instrument of each type for every 10, or part thereof furnished (minimum of 2). Included shall be any integral indicators, adapters, converters and modules needed to provide a complete functional replacement. Where similar units have been provided having different characteristics or ranges, the afformentioned quantities shall pertain to each type. Where instruments of the same type having different ranges are provided and the unit can be rescaled by field adjustment, the quantities listed shall apply to the total number provided.

3. Primary Sensing Elements

a. One spare of each size and type, complete with housing and appurtenances for each 10 or part thereof installed (Minimum of 1).

4. Pressure and Temperature Switches

a. One spare of each size, type and range, complete with housing and appurtenances for each 5 or part thereof installed (Minimum of 2).

5. Panel Mounted Instruments (Includes Loop Controllers, Digital Indicators, Run Time Meters, Isolators, converters, etc.)

a. One spare of each size, type and range, complete with housing and appurtenances for each 10 or part thereof installed (Minimum of 2).

b. In addition to the spares required above the Contractor shall provide:

1) One spare power supply for every 5 or part thereof installed (Minimum of 2).

2) One spare electronic module, indicator and/or circuit board for every 5 or part thereof installed (Minimum of 1).

3) One complete set of memory modules for each controller installed with the current program preloaded.

6. Non Electronic Gauges, Indicators, Thermometers, etc.

a. One spare gauge or indicator of each size, type and range, complete with appurtenances (diaphragms, snubbers, thermo-wells, capillaries, etc.) for each 10 or part thereof installed. All units shall be tested, certified and ready for use. Units with diaphragm seals, remote capillaries, etc., shall be filled, tested as a unit and ready for use.

b. One spare isolation/calibration valve of each size and type for each 20 installed. (Minimum of 1).

c. One spare appurtenant device (snubbers, manifolds, diaphragms, etc.) of each size and type for each 10 installed. (Minimum of 1).

7. Actuators

a. Provide 1 spare actuator of each size, type and rating (valve and damper, two position and modulating) for each 5 or part thereof installed.

8. Fuses

a. Provide 10% spare fuses (minimum of 10) for each type and rating used in field and panel instrumentation. (Including test equipment).

C. Tools:

1. Special tools, other than those normally found in an electronic Technician's tool box, required to test, diagnose, calibrate, install, wire, connect, disconnect, assemble and disassemble any digital equipment, instrument, panel, rack, cabinet or console mounted equipment for service and maintenance shall be provided (i.e., connector pin insertion and removal tools, wire crimping tool, special wrenches, special instrument calibrators/configurators, indicator lamp insertion and removal tools, etc.).

2. The Contractor shall furnish all tools and test equipment, complete with items such as instruction manuals, carrying/storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for field testing or maintaining equipment supplied under this Contract.

1.05 WORK NOT INCLUDED

A. Instrumentation/controls specifically identified in the Contract Drawings as being furnished with mechanical equipment shall be furnished and installed by the vendor or as specified elsewhere in the Contract Documents but will be calibrated and tested under this Section for proper operation and interface with the controls.

B. Electrical conduit and wire specifically shown on the electrical drawings.

1.06 UNITS

A. Units shall be as follows:

VARIABLE	UNITS
Temperature	Degree F
Pressure	

- Below Atmospheric	Inches Of Hg Absolute
-Near But Below Atmospheric	Inches Of Water
- Above Atmospheric	PSIG
-Absolute	PSIA Or Inches Of Hg Absolute
Level	0 To Linear Feet Or Quantity
Flow	
-Liquids	GPM @ 60 Degrees F
-Gas Or Vapor	SCFM @ 60 Degrees F and 14.7 PSIA
Relative Humidity	0-100%
Capacity	0-100%
Heating Load	BTUS

1.07 IDENTIFICATION

A. All instruments shall have an engraved stainless steel information tag. As a minimum the tag shall indicate the full instrument tag number, manufacturer, model, range and serial number. The tags shall be affixed with stainless steel screws. When screw mounting is not possible, a braided stainless steel lanyard shall be used. Characters shall be 1/8 inch minimum.

B. Each wall or stand mounted electronic instrument shall have mounted adjacent to it an engraved laminated tag, (white with 1/4 inch black letters), indicating tag number, system, subsystem and measured variable. Engravings shall be approved by the Engineer.

1.08 SIGNALS

A. All electronic instruments (transmitters) shall provide a linear 4 to 20 milliamp signal at a nominal 24VDC. The signal shall be proportional to the process variable indicated. Signal conditioning (such as square root extraction or frequency conversion), if needed, shall be done by the transmitter electronics.

B. All electronic devices (when available) shall be the microprocessor based “smart” type. Milliamp signals (4 - 20mAdc) shall have a superimposed Hart digital signal which will allow for remote communication with these devices. Handheld programmers shall be provided.

C. Discrete switch closure contacts shall use nominal 120 VAC control voltage. 24 Vdc discrete contact closures shall be used where indicated. All devices shall be rated for 120 Vac as a minimum. Contact rating shall be 2 amp minimum unless otherwise noted.

PART 2 - PRODUCTS

2.01 TEMPERATURE INSTRUMENTS

A. Temperature Indicating Transmitters

1. The Contractor shall furnish and install temperature elements and transmitters as stated herein.

2. The transmitter shall be separate from the element and shall be stand or wall mounted at 5 feet above finished floor. Elements shall be spring loaded, three wire, 0.385 alpha, 100 ohm platinum RTDs with dual elements (one spare). Conduit and cable shall be provided between the units under this Contract as required.

3. 3/4 inch 316 stainless steel thermo wells shall be provided for all elements

B. Temperature Switches:

The Contractor shall furnish and install temperature as stated herein.

1. Type: close coupled direct mount remote mount where required) electromechanical type.

2. Contacts: Hermetically sealed SPDT snap action type UL listed 250 VAC, 5A.

3. Housing: NEMA 4X copper free aluminum.

4. Mounting: Minimum of 1/2 inch Stainless steel NPT male thread and 1/4 inch diameter stem. Stem length ("U" dimension) shall be sized to place the stem tip in the center of the vessel or pipeline. Stainless steel 3/4 inch (minimum) NPT male thermo-wells of the proper length shall be provided for all units.

5. Range: Refer to Instrument Index.

6. Adjusting Mechanism: Temperature setting values for the range specified shall be indicated on a temperature setting scale. The normal operating range shall be within the middle one third of the total scale.

7. Dead band: Where possible, temperature adjustments shall include an adjustable dead band.

8. Accuracy: +/- 1% of full scale.

9. Electrical connections: Electrical connections to the switch unit shall be by terminal lugs. In lieu of terminal lugs, a minimum of 19 inch free leads are acceptable for explosion proof model only. In this case, the leads shall be hermetically sealed, where leaving the switch housing, and the seal must be listed by FM and/or UL. When lead type connections are furnished, a separate junction box shall be provided, connected to the switch with flexible conduit and installed. The unit and included box shall comply with all requirements of Division 16 and all area classifications.

10. Over range protection: Temperature switches shall be designed to withstand inadvertent application of temperature equal to 1.5 times full scale rating as a minimum.

11. Manufacturer: SOR, Ashcroft or approved equal.

2.02 PANEL MOUNTED INSTRUMENTS

A. Digital Indicators

The Contractor shall furnish and install Digital as specified herein.

1. Function: Display of calculated or real world process variables. Various signals are called out for digital display in the Contract Documents. Any signals that can not be displayed on the face of the appropriate SLC (the signal to be displayed must be related to the major function of the SLC), shall be displayed on combination bargraph-numeric readout display units.

2. Field and Panel Indicators: Unless otherwise noted, alpha-numeric display of indicators mounted in the field shall be LCD type panel mount shall be LED type. The height of alpha-numeric display shall be 1/2-inch minimum. External power supplies shall be provided as needed. Indication shall be in engineering units with a minimum of 1 decimal place display resolution (ie. XXX.X degree F).

B. Run Time Hour Meters

1. Type: Provide a synchronous motor driven run-time hour meter with 0.1 hour resolution.

2. Manufacturer: Cramer, or approved equal.

C. Signal Conditioners

The Contractor shall furnish and install Signal Converters as stated herein.

1. Function: Translation of incompatible signal types, ranges, voltages etc. for use by process control equipment.

2. Type: Converters shall be of the plug in type, utilizing all solid state circuitry suitable for rack mounting within panels.

3. Power supply: 120VAC, 60 Hz where required by the converter.

4. Accuracy: 0.1% of span, deadband shall be 0.1% span, maximum.

5. Remarks: Where specific converters are not listed, but are required to interface with the current or future process control system, they shall comply with the general requirements stated herein.

D. Current Isolators

The Contractor shall furnish and install Current as stated herein.

1. Function: To provide an isolated current loop, calculations or signal amplification between the plant's new, future and existing process control systems and existing analog instrumentation and control loops.
2. Type: Converters shall be of the plug in type, utilizing all solid state circuitry suitable for rack mounting within panels.
3. Power supply: 120VAC, 60 Hz where required by the converter.
4. Accuracy: 0.1% of span, deadband shall be 0.1% span, maximum.
5. Circuit loading: Isolators shall be sized such that resistance of new or existing loops shall not exceed maximum rated resistance.
6. Manufacturer: Moore Industries, or approved equal.

E. Current Switch Alarms (alarm trips)

The Contractor shall furnish and install current switch as stated herein.

F. Automatic Temperature Controllers

1. The Contractor shall furnish and install, configure and program HVAC unit temperature controllers in accordance with the following:
    a. Furnish and install automatic stand alone temperature controllers in where indicated in the Contract Documents and in the control panel of each system or piece of equipment requiring automatic temperature control.
    b. The unit shall be an electronic setpoint type controller that shall sense the space or supply temperature as indicated, and provide modulating control of the output control elements to automatically maintain the indicated temperature at set point. The controller shall provide full proportional, integral and derivative control and shall have an anti-integral windup feature.
    c. The controller shall provide reset of the current setpoint based on a separately sensed temperature. The reset function shall raise and lower the current temperature setpoint based on a programmed ration and the value if a separate temperature input.
    d. The controller shall be a single unit stand alone controller with an integral LCD graphical interface. The interface shall provide system programming and operational display of all parameters.
    e. The controller shall be powered by 24 Vac, or 120 Vac and shall have two independent programmable modulating outputs that individually configurable for 0-10 Vdc, 2-10 Vdc, 4-20 mAdc and Series 90 signals.

f. The unit shall have an internal time clock to allow scheduled setback of temperature setpoints based on time of day scheduling. Two settable time periods per day shall be individually programmable.

g. The controller shall have modulating high or low limit control to protect equipment from freezing or overheating. This function shall be used in addition to other limits required by Contract.

h. The controller shall be provided with the appropriate sensors designed specifically for the application. Sensors shall be 12-inch, fast response, averaging sensor. Space and outside air sensors shall be provided as needed.

i. The controller shall have a minimum of one (1) digital input and two (2) SPST output relays.

j. The controller shall be fully custom programmable by the Contractor for the application.

k. Controller shall be NEMA 4X rated.

l. The controller shall be Honeywell T775 Series 2000 Electronic controller or approved equal.

2.03 FLOW INSTRUMENTS

A. Flow Switches

The Contractor shall furnish and install thermal dispersion flow switches as specified herein. Thermal mass flow switches shall be furnished and under this Contract and where indicated in the Contract Documents.

1. Thermal dispersion flow switches shall be wide turndown type, insertion mount with a flow indicating LED showing flow has been established. The indicator shall be viewable from the monitored equipment control station.

2. Switches shall be field adjustable over a 30:1 flow range, operate over the 0 F to 250 F range, rated for 300 psig. They shall have solid state sensors with no moving parts, produce no detectable pressure drop at maximum flow, have 5A rated relay contacts, have adjustable trip time delay, and have NEMA 4X enclosures. Switches shall be adjusted to make 10% below the lowest expected flow rate.

3. Set point adjustment: Switches shall be set to activate at the minimum permitted flow condition for a pump. Interim settings will have to be made to allow for startup operating conditions. Final field readjustment will be required once the system flows have been adjusted and the system fully balanced.

4. Thermal dispersion flow switches shall be FCI FLT93, or approved equal.

2.04 AUTOMATIC TEMPERATURE CONTROL DEVICES

A. Temperature Elements/Transmitters

1. The Contractor shall furnish and install temperature elements and transmitters as stated herein.
2. Function: Measurement of air and water temperatures of environmental air systems for transmission to PLC control system.
3. Transmitter: Loop powered, 3 wire RTD to 4-20 mAdc mounted in cast iron probe head. The unit shall have 0.1% full scale accuracy with integral zero and span adjustments. Hart protocol shall not be required.
4. Indicator: Loop powered local LCD indicators shall be furnished and installed when indicated. As a minimum, all room sensors shall have local indicators. Indicators shall be mounted in an easily visible location with the centerline at 5 feet 0-inch above finished floor. The unit shall comply with requirements specified under the section on Digital Indicators above. The enclosure shall be in accordance with Specification 23 90 01.
5. Manufacturer: Omega Engineering Inc. or approved equal.
6. Model: (Probe) type PR-12, (transmitter) TX-92.

B. Damper/Valve Actuators (Two Position and Modulating)

The Contractor shall furnish and install damper/valve actuators in accordance with the following.

1. Function: Electrically controlled operation of two position dampers and louvers and modulating control of dampers and small valves.
2. Type: Commercial, 120 Vac, 2 position, high torque, spring return to closed position (Boiler room ventilation spring/fail open.) and modulating actuators.
3. Aux Switch Type: 2 sets, adjustable snap action contacts, 120Vac 7.2A.
4. Rating: 120Vac, w/screw terminal adapter.
5. Modulating signal: 4 to 20 mAdc.
6. Operating Range: -40 - +150 degrees F.
7. Mounting: External mounting foot.
8. Enclosure: Cast aluminum, NEMA 4X.
9. Motor/Gear Train: Oil immersed.
10. Mechanical ratings: 160 degree stroke, 60 seconds, 60 lb-in. Torque (min).
11. Accessories: Furnish and install NEMA 4 power disconnect switch for each operator.
12. Manufacturer / Model: Honeywell M4185, 86 or approved equal (2 position) and Honeywell M7284 (modulating) or approved equal.

13. Remarks: Contract drawings are diagrammatic. The actual quantity and location of damper/louver actuators required is to be determined by the Contractor and manufacturer. The actual load on any one actuator shall not exceed 80% of continuous rating. Additional actuators shall be furnished and installed to achieve the needed torque at no additional cost to the City. When additional actuators are provided, the limit switches shall be series connected. The Contractor shall provide the proper mounting hardware, linkages and adapters required for all units. Linkages shall be furnished and installed as recommended by the valve, damper and actuator manufacturer. End limit switches are required and shall be provided on all units. The switches shall be connected so that all units must complete full travel (minimum of 85%) before activation of the circuit (contacts close). Switches shall be adjustable over the entire range.

C. Freeze-stats

The Contractor shall furnish and install freeze-stats (low temperature switches) in accordance with the following.

1. Function: To provide a switch contact change of state in response to a low temperature (near freezing) condition at the outlet side of an air handling units heating coil.
2. Type: Coil face mounted, extended capillary sensor with manual reset snap action switch.
3. Range: 30 to 60 degrees F.
4. Switch Rating: SPDT 5A, 120Vac.
5. Housing: NEMA 4X, gasketed.
6. Capillary: 1/8 inch x 20 feet (minimum) copper with mounting clips (additional units shall be provided for larger coils or multiple coils as required).
7. Manufacturer: Honeywell, Barber-Coleman or approved equal.
8. Remarks: The capillary shall be mounted on the downstream side of the heating coil and shall be extended in a zig-zag pattern to cover the entire coil face or in accordance with the manufacturers written recommendations. The unit shall respond to the lowest temperature over any one foot section of the capillary. Multiple units shall be provided for HVAC units having large coils and / or multiple coils to obtain proper coverage and protection. In addition to indicating a freeze condition to the control panel, the units shall be hardwired into the unit control panel and fan control circuit to provide shutdown of the unit. Upon activation, any circulating pumps shall remain operating or shall be started to prevent freezing of the coils. Units shall require manual reset.

PART 3 - EXECUTION

3.01 GENERAL

A. Instruments shall be installed and oriented so as to be easily accessible and readable from the process floor.

B. Pressure gauges, thermometers, flow indicators, etc. when possible, shall be grouped and oriented so that all indicators of a particular system or subsystem can be viewed by the operator from a single location on the process floor. Whenever possible this central location shall be the unit or system control panel or local control station.

C. Electronic instruments of a single system or subsystem shall have their indicators and transmitters grouped so as to facilitate calibration and viewing by personnel.

D. Unless otherwise specified, instrument enclosures shall be 316 SS or copper free cast aluminum construction. PVC coating shall be provided where severe corrosion is indicated.

E. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by manufacturer.

F. It is the purpose and intent of these Documents that all process taps, isolation valves, nipples, penetrations, embedded instrumentation supports, and the installation of instrumentation and controls shall be provided under this Contract.

G. Taps and connections for primary process sensors shall be sized to suit each individual installation and the requirements of the instrument served. It is the Contractor's responsibility to ensure that the location, orientation and dimensions of the connections and taps for instrumentation furnished under this Section are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage and accessibility for maintenance while the plant is in operation.

H. The Contractor shall coordinate panel and field instrumentation which are in the same control loop. These instruments shall be of the same manufacturer and/or shall be fully matched.

I. Panel mounted instruments such as loop controllers shall be provided with a slide out chassis.

J. Instruments and controls shall contain no mercury in any quantity for any purpose.

3.02 LOCATION

A. Instrument locations indicated on drawings are diagrammatic. Actual locations shall be as close to the drawing locations as possible, in accordance with the manufacturer’s recommendations, field verified and approved by the Engineer.

B. Location and mounting detail drawings for all equipment shall be submitted to the Engineer for review and approval prior to any work commencing.

C. Transmitters, electronic indicators, etc and any device requiring routine maintenance shall be wall or stand mounted at between 4-1/2 and 5 feet with connections to process as required.

D. Equipment shall be installed in locations approved by the Engineer and out of the way of potential damage. Items shall be installed so as to provide ease of maintenance and

operation. Equipment shall not be installed where it impedes access or egress within an area. In addition, the installation shall not block or impede maintenance or operational access to other equipment.

E. Instruments and indicators shall be installed and oriented to allow the operator or service personnel to read the device while at the local control location of the associated equipment. When no local control location is provided, a central location at the equipment shall be chosen by the Engineer. All indicators and readouts shall be located so as to be readable from the process floor.

3.03 MOUNTING

A. All instruments and equipment shall be securely and rigidly supported and mounted. Equipment shall be supported by structural members and not from other equipment or systems. When instruments such as gauges and switches are supported by pipe nipples, the pipe size shall be 1/2 inch minimum to the process pipe. Where shown on the drawings, mounting details shall be followed. All equipment specified under this Section shall be installed per the Contract Documents, manufacturer's recommendations and standard industry practice. When installation methods are not shown or specified, the manufacturer's recommendations shall be used after review and approval by the Engineer. All mounting and supporting hardware and appurtenances shall be furnished and installed under this Contract.

B. Where process taps or an instrument are located more than 10 feet above finished floor, or where subject to severe or damaging vibration, instruments, both electronic and non electronic, shall be wall or stand mounted at eye level and tubing or capillary run to the process tap. With the approval of the Engineer, pressure gauges and thermometers mounted between 10 and 20 feet above the floor shall be provided in an 8 inch size rather than having remote tubing connections.

C. Instruments requiring calibration shall not be mounted more than 8 feet above the floor or their access platform. Such instruments shall be remote mounted and tubed or connected with armored capillary as appropriate, and mounted at eye level.

D. Field instruments mounted outdoors shall be mounted in thermal insulated enclosures fitted with thermostatically controlled space heaters to suit the environment. The front door of enclosure shall have a glass window to allow easy viewing of the indicator.

3.04 ELECTRICAL REQUIREMENTS

A. Instruments requiring electrical power or signal connections shall have sufficient length of flexible conduit and wire to allow easy removal without disconnection from the system. Flexible connections shall be a minimum of 12 inches and a maximum of 24 inches long unless otherwise approved by the Engineer in writing.

B. Electrical connections of wires to instruments shall be by screw terminal. When an instrument or device's terminals will not accept a #12 awg control or power wire, or when factory installed pigtails are provided, a suitable junction box, in accordance with Division 16 and area classification, shall be furnished and installed with and connected to the instrument.

C. All instruments requiring 120 Vac power shall be supplied with an external power disconnect switch and surge suppressor. The switch and suppressor shall be rated NEMA 4X and fabricated of stainless steel. Under this Contract the instrument shall be connected to the switch and isolator using 3/4 inch liquid tight flexible metal conduit and #12 awg conductors. In hazardous areas all work shall comply with the NEC and electrical specifications. Coordinate all installations with electrical installer.

3.05 ADJUSTMENT AND CLEANING

A. General

1. The System Supplier shall comply with the requirements of Division 1 and Division 23 of these Specifications and all instrumentation and control system tests, inspection, and calibration requirements for all instrumentation and controls provided under this Contract and specified herein. The Engineer, or his designated representative(s), reserve the right to witness any test, inspection, calibration or start up activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein shall not relieve the Contractor of his responsibility for meeting all specified requirements.

2. The System supplier shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the City. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

3. At least 60 days before the anticipated initiation of installation testing, the Contractor shall submit 14 copies to the Engineer of the detailed description of the installation tests to be conducted to demonstrate the correct operation of the instrumentation supplied hereunder.

B. Field Instrument Calibration Requirements

1. The System Supplier shall provide the services of factory trained instrument technicians, tools and equipment to field calibrate each instrument supplied under this Contract to its specified accuracy in accordance with the manufacturer's specification and instructions for calibration.

2. Each instrument shall be calibrated at 0, 25, 50, 75 and 100 percent of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracies as set forth by NIST (National Institute of Standards and Technology).

3. The System Supplier shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposal calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.

4. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.

5. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations, or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt, and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to over voltages, incorrect voltages, over pressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the City.

6. After completion of instrumentation installation, the System Supplier shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all Contractor representatives involved for each loop test and witnessing Engineer.

END OF SECTION

SECTION 26 00 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.02 REFERENCES

A. The following standards shall also be referenced for additional requirements. Where discrepancies arise between the Utility standards and these specifications, the more stringent requirement shall apply.

1.03 SCOPE

A. This scope covers the furnishing, installation, testing, adjusting and placing in operation all electrical equipment, devices, facilities, materials, and auxiliary items necessary for the complete and successful operation of all electrical equipment as herein described, shown on the plans, or deemed necessary for the completion of the electrical portion of the project. It is the intent of Division 26 to outline the electrical requirements of the contract in order to provide the information necessary for the construction of a fully operational system as shown on the plans and as herein described. A comprehensive electrical scope of work is as follows:

1. Power/electrical system
2. Lighting system
3. Lightning protection system
4. Grounding system
5. Connection of electrically powered mechanical equipment
6. Temporary construction power
7. All incidentals necessary for a complete and fully operational electrical system.

1.04 WORKING CLEARANCES

A. Working clearances around equipment requiring electrical services shall be verified by CONTRACTOR to comply with NEC requirements. Should there be apparent violations of clearances; the CONTRACTOR shall notify the ENGINEER before proceeding with connection or placing of equipment.

B. In the case of panelboards, safety switches and other equipment requiring wire and cable terminations, the CONTRACTOR shall ascertain that lug sizes and wiring gutters or space allowed for proper accommodation and termination of the wires and cables are adequate.

1.05 SAFETY EQUIPMENT

A. CONTRACTOR shall provide, at the completion of the project and prior to turnover to CITY, electrical equipment safety mats around each piece of interior electrical equipment with a voltage to ground greater than 50 volts. Mats shall be ¼-inch thick type 11 class 2, with a max voltage of 17,000 volts AC RMS. Mats shall meet ozone, flame, and oil resistance requirements.

1.06 WORKMANSHIP

A. Workmanship under this Division shall be accomplished by persons skilled in the performance of the required task. All work shall be done in keeping with conventions of the trade. Work of this Division shall be closely coordinated with work of other trades to avoid conflict and interference.

1.07 PROTECTION OF ELECTRICAL EQUIPMENT

A. Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage and after installation. Should any apparatus be subjected to possible injury by water, it shall be thoroughly dried out and put through a dielectric test, at the expense of the CONTRACTOR, to ascertain the suitability of this apparatus. The results of the test shall be submitted to the ENGINEER and if the apparatus is found to be unsuitable, the CONTRACTOR shall replace it without additional cost to the CITY.

B. Electrical equipment space heaters and motor space heaters shall be energized during storage periods and prior to being placed into operation to prevent moisture and condensation from damaging internal components.

C. Where indicated on the contract drawings, the CONTRACTOR shall supply a lockable steel cabinet for storing all project spare parts as listed and required within these specifications. Cabinet shall be sized sufficiently to house the spare parts plus an additional 20 percent spare capacity.

1. Cabinets located within conditioned spaces shall be NEMA1.

2. Cabinets located in unconditioned spaces shall be NEMA 12.
3. No cabinets shall be installed in hazardous areas.

1.08 UTILITIES

A. The electrical CONTRACTOR shall install a fully operational electrical service as described in the plans.

B. Arrange with the utility company for the services and install the services in accordance with their requirements, regulations and recommendations.

1.09 WARRANTY

A. CONTRACTOR shall warranty all lighting for a period of one year after substantial completion. Warranty shall include material and labor for re-lamping.

B. The CONTRACTOR shall warranty all other electrical systems, materials and unless otherwise noted, workmanship to be free from defects for a period of one year from the date of substantial completion. He shall correct all defects arising within this period upon notification by the CITY or ENGINEER, without additional compensation.

C. It is understood that the rights and benefits given the CITY by the warranties found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the special and general provisions of the contract.

1.10 TEMPORARY POWER AND LIGHTS DURING CONSTRUCTION

A. It shall be the responsibility of the CONTRACTOR to provide and maintain adequate temporary power and lighting at all times during construction, so that the various other trades can accomplish their work in a flawless manner and to maintain at all times plant operations. Particular attention will be given to power and lighting for masonry, drywall, painting, tile work and any other finish work.

1.11 MATERIAL STANDARDS

A. Material shall be new and comply with standards of Underwriters' Laboratories, Inc., where standards have been established for the particular product and the various NEMA, ANSI, ASTM, IEEE, AEIC, IPCEA or other publications referenced.

1.12 TEST EQUIPMENT

A. The CONTRACTOR shall provide all test equipment and supplies deemed necessary by the ENGINEER at no extra cost to the CITY. These supplies shall include but not be limited to the following: volt meters, amp meters, clamp-on ground rod test meter, light meters, generator load banks and temporary cables, watt meters, harmonic distortion test equipment, thermal image camera, megger tester, high pot test equipment, power quality analyzers, recording power meter, and oscilloscopes.

1.13 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.

B. ANSIC2 – National Electrical Safety Code.

C. NEMA – National Electrical Manufacturer's Assoc.

D. UL – Underwriters Laboratories

E. NFPA – National Fire Protection Assoc.

F. IEEE – The Institute of Electrical and Electronics Engineers

G. IESNA – The Illuminating Engineering Society of North America

H. NETA – International Electrical Testing Association

I. API – American Petroleum Institute

J. AGA – American Gas Association

K. Recommended Standards for Water Works and Wastewater Facilities (10 State Standards) as published by Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers.

1.14 SUBMITTAL

A. Submit under provisions of Section 01 30 00 the following certification:

1. The CONTRACTOR installing all electrical work shall review and approve all electrical shop drawings prior to submittal to the ENGINEER for review. As part of the review, the installer shall certify the following:

    a. I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is in compliance with the contract drawings and specifications, can be installed in the allocated space, will be stored in accordance with the manufacturer's recommendation, will be installed per NEC, and is submitted for approval.

       Certified by: _____ Date: _____

    b. Contractor shall state clearly in each submittal any deviations from the contract documents, referencing applicable specification sections and reasoning for deviation. Deviations are contingent upon ENGINEER review and approval.

B. Submit shop drawings and product data grouped to include complete submittal of related systems, products, and accessories in a single submittal to the requirements of Section 01 30 00. No electrical work may be performed until shop drawings are approved. Submit shop drawings in accordance with the requirements of the respective division 26 specification section included as part of these project documents. Included are such things as:

    1. Low Voltage Power/Electrical System

        a. Generator
        b. Automatic Transfer Switch
        c. Panelboards
        d. Motor controllers
        e. Power distribution equipment
        f. Conduit and Conduit Fittings
        g. Wire
        h. Pull Boxes
        i. Circuit Breakers
        j. Disconnects
        k. Fuses
        l. Conduit Support Systems
        m. Wiring Devices
        n. Transformers

o. Surge Protection Equipment
p. Arc Flash Study
q. Breaker Coordination Study (BREAKERS OR FUSES WILL NOT BE APPROVED WITHOUT AN APPROVED COORDINATION STUDY)

2. Lighting System

a. All Light Fixtures

1) Computer Printout of Lighting Layout
2) Sample Fixture (as directed by ENGINEER)
3) IES Photometric Files

b. Poles and Foundations

3. Miscellaneous Electrical Equipment

a. Miscellaneous Electrical Parts

4. Drawings

a. Coordination drawing of all electrical areas
b. Conduit layout drawings
c. Duct drawings
d. As-Built Drawings

C. Mark dimensions and values in units to match those specified.

1.13 REGULATORY REQUIREMENTS

A. Conform to applicable sections of the Building Code and all local rules, regulations and ordinances.

B. Obtain permits and request inspections from authority having jurisdiction.

C. Electrical: Conform to NFPA 70 & National Electric Safety Code

1.14 FINAL INSPECTION AND TESTING

A. After the electrical installation is complete, the CONTRACTOR shall deliver to the ENGINEER the following information with his request for final inspection.

1. One set of contract drawings marked to show all significant changes in equipment ratings and locations, alterations in locations of conduit runs, or of any data differing from the contract drawings. This shall include revised or changed panelboard and switchgear schedules.
2. Certificates of final inspection from local authority.
3. A tabulation of all motors listing their respective manufacturer, horsepower, nameplate voltage and current, actual running current after installation and overload heater rating.

B. The electrical work shall be thoroughly tested to demonstrate that the entire system is in proper working order and in accordance with the plans and specifications. Each motor with its control shall be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity, speed and satisfactory operation. All main switches and circuit breakers shall be operated, but not necessarily at full load. CONTRACTOR may be required during final inspection, at the request of the ENGINEER to furnish test instruments for use during the testing.

C. All wiring shall be given a megger test using a 1000 Volt megger and a conductor continuity test. These tests shall be performed upon delivery to project site and after conductors are pulled, but before final connections are made. The ENGINEER shall be given two days' written notice of the anticipated test date so that he may witness the test if so desired. In any event, the CONTRACTOR shall record the circuit designation and the megger reading on each phase. This written record shall be submitted to the ENGINEER prior to energization of associated equipment. The cost of this test or any retest caused by insufficient megger readings shall be the responsibility of the CONTRACTOR (All tests shall be done in accordance with NETA Standards).

1.15 STAFFING

A. The electrical CONTRACTOR shall provide a “Master Electrician” who has been deemed a “Master Electrician” by exam through the State, or any other local permitting authority as the electrical superintendent for the project. The electrical superintendent shall be on the project site any time any electrical work is performed by the CONTRACTOR.

B. Or, the electrical contractor shall provide one “Journeyman Electrician” who has been deemed a “Journeyman Electrician” by exam through the State of Florida, or any other Florida County Permitting Authority for every four electrical helpers used on the project site. A Journeyman shall be on the project site any time any electrical work is performed by the contractor.

1.16 AS-BUILT DRAWINGS

A. The as-built drawings shall include detailed drawings of all duct banks, underground conduit, above ground conduit, power distribution equipment, PLC control panels, and control instrument drawings. The duct bank and conduit drawings shall indicate exact location of all duct banks, underground electrical wiring, and fiber optic cable.

1. The location shall indicate the following:

    a. Centerline location
    b. Width / Cross section
    c. Depth

B. As-built drawings shall be furnished to the ENGINEER in AutoCad 2018 and PDF format.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 50
OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This specification 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.

B. The specification includes a computer based, overcurrent protective device coordination study to confirm protective device ratings and ensure coordination between upstream and downstream breakers.

C. The study shall include the entire electrical system (both existing and proposed) for each facility.

D. CONTRACTOR shall coordinate with the utility electrical service provider to obtain up to date available fault current contribution in order to prepare the documents required by this specification.

1.03 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.

1.04 ACTION SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. Product Data: For computer software program to be used for studies.

C. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submit three signed and sealed reports by a professional ENGINEER in the state of Florida and one complete electronic copy including all computer files.

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, licensed in the State the project is located.

    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 ENGINEER for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. Qualification Data: Professional Engineer in the state of Maryland.

C. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 CLOSEOUT SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

1.07 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 in the state of Florida.

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 the Project is located. All elements of the study shall be performed under the direct supervision and control of this professional ENGINEER.

PART 2 – PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers: Subject to compliance with requirements, provide software by one of the following:

1. SKM Systems Analysis, Inc. (Power Tools for Windows)

B. Comply with IEEE 1584 and NFPA 70E.

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.

2.02 SHORT-CIRCUIT 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:

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.

F. 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.

G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.03 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 16075 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester 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.
8. PPE required.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. New overcurrent protective devices shall not be approved until completion of the arc-flash study.

3.02 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.

1. Service Entrance: Type XHHW-2, single conductors in raceway.

D. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

E. 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 ac systems.

F. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following applicable equipment:

1. Electric utility's supply termination point
2. Low-voltage switchgear
3. Motor-control centers
4. Standby generators and automatic transfer switches
5. Branch circuit panelboards
6. Control Panels

3.03 PROTECTIVE DEVICE COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals. (Comply with NEC for selective coordination NFPA 70; 240.12, 700.27, 701.18).

C. 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.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves 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.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

    a. Device tag.

b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to 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:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

F. Provide completed data sheets for setting of overcurrent protective devices bound in a 3-ring binder.

3.04 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the contribution from all sources is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from all sources 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. 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.

F. 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).

G. 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.

3.05 POWER SYSTEM DATA

A. Obtain all data necessary to conduct the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of the CITY and ENGINEER.
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.

B. Gather and tabulate the following input data to support coordination 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.

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. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, 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 and available range of settings, 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. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
9. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
10. Motor horsepower and NEMA MG 1 code letter designation.
11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.06 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 applicable locations:

1. Transfer switches
2. Switchboards
3. Panelboard
4. Variable frequency drives

5. Control panels
6. Disconnects

3.07 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

END OF SECTION

SECTION 26 06 00
GROUNDING AND BONDING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

B. For definitions of grounding and bonding terms see NFPA 70.

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.03 ACTION SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

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

1. Include the following:

a. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS.

1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.06 QUALITY ASSURANCE

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

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

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning and Grounding.
4. ILSCO.
5. O-Z/Gedney; A Brand of the EGS Electrical Group.
6. Robbins Lightning, Inc.
7. Or Engineer approved equal

2.02 SYSTEM DESCRIPTION

A. Complete grounding system including connections to proposed equipment and structures and interconnection with existing grounding system according to these specifications and the contract drawings.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

D. Grounding and Bonding Conductors

1. All raceways and equipment shall be provided with an equipment grounding conductor as shown on the drawings. When the equipment grounding conductor is not shown on the drawings, provide an equipment grounding conductor per Table 250.122 of the NEC.
2. All service entrance equipment shall be provided with a grounding electrode conductor between the service entrance ground and the grounding electrode system as shown on the drawings. When the grounding electrode conductor is not shown on the drawing, provide a grounding electrode conductor per Table 250.66 of the NEC.
3. Main bonding jumper installed between the service entrance ground and neutral and shall be sized per Table 250.66 of the NEC.
4. System bonding jumper installed between the separately derived system ground and neutral and shall be sized per Table 250.66 of the NEC.

2.04 CONNECTORS

A. Listed and labeled by a Nationally Recognized Testing Laboratory (NRTL) acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.05 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m) min.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturers recommended material.

PART 3 – EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:

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

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. When service grounding is not detailed on the drawings, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of area.

1. Install copper conductor not less than No. 2/0 AWG or as shown on the drawing for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet (6.0 m) long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81 and NETA Standards.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and

other phenomena that may affect test results. Describe measures taken to improve test results.

5. Prepare test and inspection reports.

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

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

1. Power and lighting equipment or system with capacity of 1000 kVA and less: 5 ohms.
2. Power and lighting equipment or system with capacity more than 1000 kVA: 3 ohms.
3. Power distribution units or panelboards serving electronic equipment: 3 ohm(s).
4. Substations and pad-mounted equipment: 5 ohms.
5. Manhole grounds: 10 ohms.

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

END OF SECTION

SECTION 26 07 10
HANGERS AND SUPPORTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified Florida registered professional ENGINEER, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operation weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for the Project, with a minimum structural safety factor of five times the applied force.

1.05 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional ENGINEER in the state of Florida. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers: Include product data for components.
2. Steel slotted channel systems: Include product data for components.
3. Nonmetallic slotted channel systems: Include product data for components.
4. Equipment supports.

1.06 INFORMATIONAL SUBMITTALS

A. Welding Certificates

1.07 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

1.08 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolts inserts into bases. Concrete, reinforcement, and framework requirements are specified together with concrete Specifications.

B. Coordinate installation of roof mounted electrical with structural and architectural specification and drawings.

PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit
b. Cooper B-Line, Inc.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Atkore International.
g. Wesanco, Inc.
h. Or approved equal

2. Metallic Coatings: Hot dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturers standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch—(14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, INC.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.
e. Or approved equal.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items maybe stainless steel.
4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
1. Provide cable strain relief for manufacturer provided cables where installation is intended to be vertically in free air. Support grips shall be sized for the cable and shall prevent the cables from being damaged by the process or installation, while ensuring maintenance activities are not inhibited.

D. Conduit and Cable Support Devices shall be as indicated below (unless noted otherwise in drawings):

1. PVC Conduit – PVC, stainless steel, or fiberglass in areas corrosive to stainless steel
2. RGS Conduit – galvanized steel
3. Aluminum Conduit – stainless steel
4. PVC Coated RGS – stainless steel, fiberglass in areas corrosive to stainless steel
5. EMT – painted or galvanized steel

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structured Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Hilti, Inc.
        2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.
        5) Or Approved Equal

2. Mechanical-Expansion Anchors: Insert-wedge type, stainless steel, for use in hardened Portland cement concrete with tensions, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.
6) Or Approved Equal

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MMS Type 18; complying with MFMA-4 or MSS SP-58.
4. Beam Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

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

PART 3 – EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and system except if requirements in this Section are more stringent.

B. Maximum, Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacing less than stated in NFPA 70. Minimum rod size shall be $^{3}/_{8}$ inch in diameter.

C. Provide cable strain relief for manufacturer provided cables where installation is intended to be vertically in free air. Support grips shall be sized for the cable and shall prevent the cables from being damaged by the process or installation, while ensuring maintenance activities are not inhibited.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200lb (90kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete

    a. Expansion anchor fasteners.
    b. Powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100mm) thick.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted to Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panel boards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and replace miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements as specified in the contract documents.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instruction, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touch-up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 07 50
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors of power, communication, and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.02 QUALITY ASSURANCE

A. Comply with ANSI A13.1, ANSI C2, and ANSI Z635.4.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, shop drawings, manufacturer's wiring diagrams, Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

E. Install all signs and labels horizontal (level) and consistent for similar equipment and panels.

PART 2 – PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 CONDUCTORS, COMMUNICATION, AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

B. Self-laminating vinyl labels with printed 3/16-inch identification protected by translucent lamination adhered to cables or conductors with permanent acrylic tape. Resistance to chemical or other solvents, water, dirt, and oils. UL approved and RoHS compliant.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum width: 3/16 inch.
2. Tensile Strength: 50lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

PART 3 – EXECUTION

3.01 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with snap-around label.

1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands:

1. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
2. Fire Alarm System: Red.
3. Fire-Suppression Supervisory and Control System: Red and yellow.
4. Combined Fire Alarm and Security System: Red and blue.
5. Security System: Blue and yellow.
6. Mechanical and Electrical Supervisory System: Green and blue.
7. Telecommunication System: Green and yellow.
8. Control Wiring: Green and red.

C. Power, Control, Instrumentation, and Branch Circuit Identification: Where cables or conductors terminate on terminal blocks or equipment, use wrap around vinyl sleeves with pre-printed labels.

1. Cables and conductors shall be identified with a tag on each end indicating its opposite end termination location.
2. Line 1 shall indicate the cable or circuit number found in the conduit and cable schedule or panelboard circuit for contractor supplied and field routed cables and conductors not found in the conduit and cable schedule. For example: “P-PP-6001” for circuits in the schedule or “LP-0100-24” for panelboard circuits.
3. Line 2 shall indicate the opposite end location termination point with equipment designation, terminal block designation, and terminal number. For example: “CP-1600, TB1-24”.

D. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and hand holes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

1. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

F. Conductor Color Code Identification: Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a given branch circuit shall be identified by color coded tape or cable insulation at all termination, connection or splice points.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

1. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
4. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway. During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches above duct. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

1. Description:

a. Permanent, bright-colored, continuous-printed, polyethylene tape.
b. Not less than 6 inches wide by 4 mils thick.

c. Compounded for permanent direct-burial service.
d. Embedded continuous metallic strip or core.
e. Printed legend shall indicate type of underground line.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. 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. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

2. Comply with NFPA 70 and 29 CFR 1910.145.
3. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
4. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
5. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

a. Warning label and sign shall include, but are not limited to, the following legends:
b. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
c. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with ENGINEER/CITY APPROVED instructions where needed for system or equipment operation. Instructions are needed for all equipment unless otherwise noted.

a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
b. The engraved legend shall be ½ -inch white letters on brown face, and punched or drilled for mechanical fasteners.
c. The signs shall be installed with stainless hardware.

2. Emergency Operating Instructions: Install emergency operating instruction signs at equipment used for power transfer, safety shutdown, or any other locations requiring operation in an emergency.

a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
b. The engraved legend shall be ½ -inch white letters on red face, and punched or drilled for mechanical fasteners.
c. The signs shall be installed with stainless hardware.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor and Outdoor Equipment: Use engraved, laminated acrylic or melamine labels, punched or drilled for screw mounting. Identification labels shall have black letters on a white background. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1 1/2-inch high label; where 2 lines of text are required, use labels 2-inches high. Mount labels with stainless hardware. (Labels for field mounted equipment shall include the name of the equipment, and the location from which power is feed. See example below:

1) Main Station Control Panel

a) Fed from LP-1

b. Elevated Components: Increase the size of the labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
b. Panelboards, electrical cabinets, and enclosures.
c. Transformers.

d. Disconnect switches.
e. Motor starters.
f. Push-button stations.
g. Voice and data cable terminal equipment.
h. Monitoring and control equipment.
i. Uninterruptible power supply equipment.
j. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
k. Control systems
l. Field mounted control devices
m. Field mounted instruments

3.02 INSTALLATION PRACTICES

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

D. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes LARGER than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
5. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, the color codes used to identify each phase, neutral (if applicable) and ground conductor throughout the system shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment. Provide factory printed, multicolor, pressure-sensitive adhesive labels,

configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

F. Painted Identification: Prepare surface and apply paint according to Section 09 90 00.

END OF SECTION

SECTION 26 12 00
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.03 ACTION SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Product data: for each type of product

1.04 INFORMATIONAL SUBMITTALS

A. Submit the following in accordance with Section 01 30 00:

1. Qualification data: for testing agency
2. Field quality-control reports
3. Standard test record sheets

PART 2 – PRODUCTS

2.01 CONDUCTORS AND CABLES

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

1. Alpha Wire.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.

5. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658. Unless specifically shown on the plans as aluminum.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, RHW-2 Low Smoke, SOW and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC, Type SO with ground wire.

2.02 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. IIsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical; Markets Division.
9. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, capacity rating, material, type, and class for application and service indicated.

2.03 SYSYEM DESCRIPTION

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

B. Comply with NFPA 70.

PART 3 – EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 18 AWG and smaller; stranded for No. 16 AWG and larger.

B. General Branch Circuits in building for lighting and receptacles: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. All water and wastewater facilities:

1. Feeders concealed in concrete, below slabs-on-grade, and underground: Type XHHW-2, single conductors in raceway.
2. Branch Circuits concealed in ceilings, walls, and partitions of an air-conditioned space: Type THHN-THWN, single conductors in raceway metal-clad cable, Type MC.
3. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type XHHW-2, single conductors in raceway.
4. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire mesh, strain relief device at terminations to suit application.
5. Class 1 Control Circuits: Type XHHW-2, in raceway.
6. Class 2 Control Circuits: Type XHHW-2, in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

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

B. Complete raceway installation between conductor and cable termination points according to Division 16 prior to pulling conductors and cables.

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

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

E. Support cables according to Section 26 07 10 “Hangers and Supports for Electrical Systems.”

3.04 CONNECTIONS

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

UL 486A-486B. All torque tightening equipment shall be calibrated before use with calibration records available for inspection.

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

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 07 50 "Identification for Electrical Systems."

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

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 13 10, "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to the project specifications.

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Record all results and submit to engineer for approval. Certify compliance with manufacturer's test parameters, in the absence of Manufacturer's published data; certify compliance with the table listed in NETA Acceptance Testing Specification.
2. All testing must be carried out to competent persons.
3. NETA Acceptance Testing Specification is the minimum level of testing that will be required on all projects with the most relevant inspection and test procedures

extracted as listed below. The following list includes additional tests that will be required unless stated otherwise.

a. Pre-connection

1) Visual mechanical inspection.
2) Perform resistance measurements through bolted connections with a low resistance DC Ohm meter or an insulation resistance test meter.
3) Continuity of all protective conductors to be recorded using a low resistance DC Ohmmeter or an insulation resistance test meter.
4) Check continuity of all conductors and verify correct cable connections.
5) Check polarity of all conductors.
6) Perform insulation resistance test on each conductor with respect to ground and all adjacent conductors using an insulation resistance test meter. Each conductor must be tested for 1 minute.
7) Verify uniform resistance of all parallel conductors.

b. Post-connection

1) Test and record the impedance at the supply origin.
2) Test and record the ground fault loop impedance between all live conductors and ground at the furthest extents of each final circuit. This test is to be completed using a fault loop Impedance tester and all results must be in compliance with the Circuit Protective Device (CPD) limits from the Manufacturer.
3) Test and record the operating trip time of all GFI and GFCI's devices to ensure compliance with NEC and Manufacturer's published data. This test is to be completed using a GFCI test meter.
4) Other functional testing may be listed here if required.

4. Infrared Scanning: After substantial completion, but not more than 60 days after final acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
2. List of test personal with resumes.

3. Summit all test results on the enclosed test forms, see form to follow.
4. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

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

(FORM TO FOLLOW)

END OF SECTION

TEST RECORD SHEET

SHEET NUMBER

CLIENT NAME: INSTALLATION ADDRESS:

CATEGORY (Industrial, Commercial, Residential, Other) TYPE OF INSTALLATION: NEW REHAB EXISTING TEMP. OTHER

RESTRICTIONS (EQUIPMENT VULNERABLE TO TESTING):

Circuit Label	Circuit Designation	Cable			No. of Points	Overcurrent		Continuity of Ground Conductors (Ω)	All Lives to Ground (MΩ)	Ø(A) to All Lives (MΩ)	Ø(B) to All Lives (MΩ)	Ø(C) to All Lives (MΩ)	N To All Phases (MΩ)	Polarity	L-Gnd Ground Fault Loop Impedance (Ohms)	Functional Testing		Comments
		Type	Size	Gnd. Size		Type	Rating (Amps)									GFCI Trip Time (ms)	Other	

Deviations from Code or Specifications:

DISTRIBUTION BOARD	
LOCATION:	
DISTRIBUTION BOARD REFERENCE:	
MAIN PROTECTIVE DEVICE: TYPE	
SUPPLY CABLE TO DB: TYPE:	
RATING (A):	
SIZE:	

ELECTRICITY SUPPLY	
VOLTAGE:	
FREQUENCY:	
NO. OF PHASES:	
PFC (kA):	
IMP. AT ORIGIN (Ω):	

TESTERS/INSTRUMENTS			
TYPE	BRAND	MODEL	CALIBRATION DATE
INSULATION			
CONTINITY			
LOOP IMPEDANCE			
GFCI TESTER			
OTHER			

PRE-COMMISSIONING TESTING COMPLETED BY (BLOCK LETTERS) SIGNATURE: DATE OF TESTING:

POST-COMMISSIONING TESTING COMPLETED BY (BLOCK LETTERS) SIGNATURE: DATE OF TESTING:

SECTION 26 13 00
RACEWAYS AND BOXES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, 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.

1.03 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

D. EMT: Electrical Metallic Tubing

E. PVC: Polyvinyl Chloride Conduit Schedule 40, Schedule 80

F. LFMC: Liquidtight Flexible Metallic Conduit

1.04 ACTION SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

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

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

1.05 INFORMATIONAL SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

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

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

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, include 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.

D. Source quality-control reports.

PART 2 – PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.
13. or Approved Equal.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Rigid Conduit

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

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel or aluminum.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

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

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

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

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.

3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corporation.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; Hubbell.
12. Thomas & Betts Corporation.
13. or Approved Equal.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. See Evaluations for descriptions of nonmetallic conduit types.

D. ENT: Comply with NEMA TC 13 and UL 1653.

E. RNC: Type EPC-40-PVC, or EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

F. LFNC: Comply with UL 1660.

G. Rigid HDPE: Comply with UL 651A.

H. Continuous HDPE: Comply with UL 651B.

I. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

J. RTRC: Comply with UL 1684A and NEMA TC 14.

K. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

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

2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Mono-Systems, Inc.

4. Square D.
5. or Approved Equal.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for interior or Type 4X stainless steel for exterior unless otherwise indicated, and sized according to NFPA 70.

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

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

D. Wireway Covers: Hinged type for NEMA 1 and hinged, flanged-and-gasketed type for NEMA 4X unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

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

1. Allied Moulded Products, Inc.
2. Hoffman.
3. Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.
5. or Approved Equal.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester or PVC, extruded and fabricated to required size and shape, and having hinged cover with captive screws.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.05 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman.
7. Hubbell Incorporated.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney.
12. RACO; Hubbell.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.
18. or Approved Equal.

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

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

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum to match raceway type, Type FD, with gasketed cover.

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

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

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

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover, unless otherwise noted.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep), unless otherwise noted.

J. Gangable boxes are prohibited, unless specifically noted.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4X Stainless Steel for outdoor locations, Type 12 for indoor locations, 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: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

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

2.06 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. NewBasis.
    d. Oldcastle Precast, Inc.
    e. Quazite: Hubbell Power System, Inc.
    f. Synertech Moulded Products.
    g. Or approved equal.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open 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, as required to identify system indicated on the drawings.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 24-inches wide by 24-inches long by 24-inches deep and larger: 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 fiberglass unless otherwise noted.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. NewBasis.
    d. Nordic Fiberglass, Inc.
    e. Oldcastle Precast, Inc; Christy Concrete Products.
    f. Quazite: Hubbell Power System, Inc; Hubbell Power Systems.
    g. Synertech Moulded Products.
    h. Or Approved Equal.

2. Standard: Comply with SCTE 77.
3. Color of Frame and Cover: Gray.
4. First option in "Configuration" Subparagraph below facilitates bottom conduit entry. Second option may be provided by a separate slab placed in the excavation under an open-bottom enclosure; third option is obtained by molding or fabricating the bottom integrally with the body of unit.
5. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
6. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
7. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
8. Cover Legend: Molded lettering, as required to identify system indicated on the drawings.
9. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
10. Handholes 24-inches long by 24-inches deep and larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional ENGINEER in the State of Florida shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

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

1. Exposed Conduit: PVC Coated aluminum rigid conduit (ARC)
2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC, unless otherwise indicated on drawings.
3. Underground Conduit: RNC, Type EPC-40-PVC when concrete encased, Type EPC-80-PVC when direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC unless otherwise indicated on drawings.
5. Connection between structures (Including between ground storage tanks and stair platforms): LFMC unless otherwise indicated on drawings. Power level 120VAC and above LFMC between rigid conduit sections or between rigid conduit and equipment shall have an insulated ground jumper installed between insulated ground bushings.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X Stainless steel unless otherwise indicated on drawings.

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

1. Exposed, Not Subject to Physical Damage: ARC.
2. Exposed, Not Subject to Severe Physical Damage: ARC.
3. Exposed and Subject to Severe Physical Damage: ARC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

d. Gymnasiums.

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: ARC unless otherwise noted.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X stainless steel in institutional and commercial kitchens and damp or wet locations, unless otherwise noted.
8. Corrosive environments (i.e. hypochlorite storage area): Type EPC-80-PVC

C. Minimum Raceway Size: 3/4-inch (21-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 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. Insulated grounding bushings where applicable.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

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

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.02 INSTALLATION

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

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. 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 (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. 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 (3-m) 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 thread less fittings in concrete unless specifically approved by ENGINEER for each specific location.
5. Some authorities having jurisdiction may not permit nonmetallic tubing in fire-rated slabs in subparagraph below.
6. Change from ENT to GRC before rising above floor.

I. 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.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

M. 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.

N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Clean and cap underground raceways designated as spare above grade alongside raceways in use.

P. 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.

Q. 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 raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

S. Expansion-Joint Fittings:

1. Provide expansion joint fitting any time conduit systems cross building expansion joints or structural expansion joints.
2. Provide expansion fittings as recommended by the manufacturer of the conduit.
3. Provide expansion fittings per NFPA 70.
4. Formula in first subparagraph below provides about 15 percent safety factor (extra expansion-contraction capability).
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.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
3. Provide a separate ground jumper for all liquid tight flexible power level conduits runs utilizing insulated grounding bushings sized as follows:

a. ¾” to 1” conduit - #12 awg insulated ground
b. 1 ¼” to 2” conduit - #8 awg insulated ground
c. 2 ½” to 6” conduit - #4 awg insulated ground

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Provide a flat surface for a raintight connection between boxes and cover plate or supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. 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.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AA. Set metal floor boxes level and flush with finished floor surface.

BB. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction per 95 percent modified proctor density.
3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor. Wrap conduit with 2 coats of 3M Scotch Wrap or Approved Equal.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.

b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

4. Underground Warning Tape: Comply with requirements in Section 26 07 50 "Identification for Electrical Systems."

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 13 10 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 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

SECTION 26 13 10
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. For penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items, use UL listed assemblies for the type and installation applied.

1.03 ACTION SUBMITTALS

A. Submit in accordance with Section 01 30 00:

1. Product data: for each type of product

PART 2 – PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40. (For use with grounding electrode conductors only.)

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

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

    a. Advance Products & Systems, Inc.
    b. CALPICO, Inc.
    c. Metraflex Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.
    f. or Approved Equal.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

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

    a. Presealed Systems.
    b. or Approved Equal.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 – EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 90 00 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install steel pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

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

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 28 90
SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:

1. Section 26 44 20 "Panelboards" for factory installed SPDs.

1.03 DEFINITIONS

A. I_n: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to unlimited, cost free replacement of SPDs that fail in materials or workmanship within specified warranty period. Acceptable manufacturers listed below that do not meet the warranty as standard shall submit a letter extending the warranty with the product submittal.

1. Warranty Period: Twenty-Five years from date of Substantial Completion.

B. Maintenance Restrictions: No SPD shall be supplied which requires scheduled preventative-maintenance or replaceable parts (other than replaceable LEDs or batteries for diagnostic circuits). Units requiring functional testing, special test equipment, or special training to monitor SPD status are not acceptable. SPDs shall require no routine maintenance. SPDs are considered non-repairable items and shall be fully replaced upon failure.

1.08 MANUFACTURERS

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

1. ABB France. (Current Technology)
2. Eaton Corporation, (Innovative Technology.)
3. Emerson Electric Co. (Liebert)
4. Surge Suppression, Inc
5. Total Protection Solutions
6. Manufacturers Not Listed:

a. Pre-Approval submittals for products by manufacturers not listed above

must be submitted not less than ten (10) business days prior to bid date to allow ample engineering time for review of submitted products. Products not submitted within this timeframe will not be reviewed.

b. Submit proper documentation showing detailed (line-by-line) compliance with this specification. Prior approvals not received by the deadline date defined above will not be considered.
c. Along with the line-by-line compliance from manufacturers not listed herein, pre-approval surge suppression submittals shall include all the items listed in part 1.5.
d. Incomplete submittal packages will not be approved

PART 2 - PRODUCTS

2.01 GENERAL SPD REQUIREMENTS

A. SPD with 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. All Surge Protective Devices (SPDs) shall be tested and listed to the latest edition of ANSI/UL 1449-2006. "Manufactured in accordance with UL 1449" is not equivalent to being listed to ANSI/UL 1449-2006 and does not meet the intention of this specification

D. MCOV of the SPD shall be the nominal system voltage.

E. The use of any mechanical or electro-mechanical thermal/over- current protection (i.e., moving parts and/or springs and shutters) in combination with or for the protection of the suppression elements is expressly prohibited and will be rejected. Large-Block 34mm (50kA) square Thermal Protected MOVs are expressly prohibited and will not be accepted.

F. Component Limitations: The SPD shall only use solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that "crowbar" short-circuit the AC power system (e.g., spark gaps, gas tubes, selenium cells, or SCR's) shall not be acceptable. Device circuitry shall be bi-directional, enclosed in a UL listed encapsulated thermal stress reducing compound, and be of a parallel design.

G. SPD units shall be UL 1283 Listed as an Electromagnetic Interference Filter and marked accordingly.

H. Provide SPDs with the following modes of protection:

1. Three-Phase, Four Wire systems: 10 Modes: L1-L2, L2-L3, L3-L1, L1-N, L2-N, L3-N, L1-G, L2-G, L3-G, N-G
2. Three-Phase, Three Wire systems: 6 Modes: L1-L2, L2-L3, L3-L1, L1-G, L2-G, L3-G
3. Single-Phase, Three Wire Systems: 6 Modes: L1-L2, L2-N, N-L1, L1-G, L2-G, N-G

2.02 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1 or Type 2 as specified in the Contract Drawings.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1 or Type 2 as required

1. SPDs with the following features and accessories:

a. Integrals disconnect switch (Type 1 SPDs only.).
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at [**5 A and 250-V ac**] [**2 A and 24-V ac**], one normally open and one normally closed, for remote monitoring of protection status. [**Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.**]
e. Surge counter.
f. Audible alarm

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 300 kA PER PHASE. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in each mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [1200 V for 480Y/277 V] [600V for 208Y/120 V].
2. Line to Ground: [1200 V for 480Y/277 V] [600V for 208Y/120 V].
3. Line to Line: [1800V for 480Y/277 V] [1000 V for 208Y/120 V].

E. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 600V.
2. Line to Ground: 600V.
3. Line to Line: 1000 V.

F. SCCR: Equal or exceed 200 kAIC.

G. Nominal Discharge Current (I_n) Rating: 20 kA.

2.03 SWITCHBOARD, PANELBOARD AND MCC SUPPRESSORS

A. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. [**Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.**]

B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 120 kA PER PHASE [] <>. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in each mode.

C. Protection modes and UL 1449 VPR for grounded wye circuits with, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: [1200 V for 480Y/277 V] [600V for 208Y/120 V].
2. Line to Ground: [1200 V for 480Y/277 V] [600V for 208Y/120 V].
3. Neutral to Ground: [1200 V for 480Y/277 V] [600V for 208Y/120 V].
4. Line to Line: [1800V for 480Y/277 V] [1000V for 208Y/120 V]

D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 600V.
2. Line to Ground: 600V.
3. Neutral to Ground: 600V.
4. Line to Line: 1000V.

E. SCCR: Equal or exceed 200 kAIC

F. Nominal Discharge Current (I_n) Rating: 10 Ka.

G. Sinewave Tracking/Frequency Responsive Capability.

1. SPDs installed to protect Switchboards, Panelboards or MCCs serving sensitive electronic equipment shall utilize voltage independent, frequency responsive dedicated Sinewave Tracking circuitry to mitigate the effects of switching or ringing surges.
   a. Sensitive Electronic Equipment shall include, but is not limited to:

1) Variable Frequency Controllers
2) Lighting with Electronic Ballasts

b. SPDs with Sinewave Tracking/Frequency Responsive Capability shall not be applied to individual Sensitive Electronic Equipment.

2. EMI/RFI filtering specifically will not be considered as equal to sinewave tracking.
3. Devices with Sinewave Tracking circuitry shall be tested in accordance with the latest edition of IEEE C62.41.2 for a Category A Ring Wave (2000 volt – 67-amp ring wave)

a. The maximum amplitude shall be less than 50V peak deviation from the insertion point of the surge on the sine wave to the peak of the transient.

2.04 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4X

2.05 CONDUCTORS AND CABLES

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

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than [**No. 18**] [**No. 22**] [**No. 24**] AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than [**No. 14**] [**No. 16**] [**No. 18**] AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD. DO NOT WIRE DIRECT TO PANEL BUS

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and

straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over

3.02 FIELD QUALITY CONTROL

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

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train City's maintenance personnel to operate and maintain SPDs.

END OF SECTION

SECTION 26 41 00
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Molded Case Circuit Breakers (MCCBs)
2. Fusible Switches
3. Non-fusible switches
4. Enclosures.

1.03 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels. Coordinate with other disciplines to ensure installation does not impact constructability and meets installation requirements of the contract documents and manufacturer’s recommendations.

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings in accordance with specification 01 30 00 and as follows:

1. Plans, elevations, sections, details
2. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 3,300 feet.

1.07 SPARE PARTS

A. Furnish spare parts that match components installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Relays: Two of each type and style installed.

5. Terminal Blocks: 10 percent spare terminal blocks installed within the equipment. These are installed and not shipped loose.

1.08 WARRANTY

A. Manufacturer's Warranty:

1. Warranty Period: One year from date of Substantial Completion. Manufacturer agrees to repair or replace equipment that fail in materials or workmanship within specified warranty period.

PART 2 – PRODUCTS

2.01 FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: 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, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: 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, and interlocked with cover in closed position.

D. 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, capable of being grounded and bonded; 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.
6. Hook stick Handle: Allows use of a hook stick 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.

2.02 NON-FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240 or 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.

C. Type HD, Heavy Duty, Double Throw, 240 or 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.

D. 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, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hook stick Handle: Allows use of a hook stick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 MOLDED-CASE CIRCUIT BREAKERS

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents. Breaker shall be suitable for service entrance and shall be 100% rated.

C. 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^2t response.

D. Features and Accessories (provide only when shown on the drawings as required):

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. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One normally open contact that operates only when circuit breaker has tripped.
9. Surge Protection: Furnish surge protection devices on the load side of the main service breaker in accordance with Section 16289 – Low Voltage Surge Protection. SPDs shall be factory wired and integral to the main service breaker enclosure.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Conditioned Dry and Clean Locations: NEMA Type 1.
2. Line side shall be bottom entry.
3. Load side shall be top entry.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in specification 26 07 50 "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.
3. Service entrance equipment shall be labelled by the manufacturer or installation contractor with nominal system voltage, available fault current, OCPD clearing time, and date label was applied. Where arc flash labels are also applied, the required information can be distributed between the labels.

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 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 based on results of specification 26 05 50 “Overcurrent Protective Devices Arc - Flash Study".

END OF SECTION

SECTION 26 44 10
PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Electronic-grade panelboards.

1.03 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing indicating the connected load for each breaker in accordance with the NEC. Schedule to be typed and dated.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Provide spare breakers as shown in the schedules on the drawings
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with the manufacturer's recommendations.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by CITY or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify ENGINEER and CITY no fewer than 10 working days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without ENGINEER and CITY's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: see plan sheet panel schedule for enclosure types and mounting.

1. Provide rated enclosures as shown below unless otherwise indicated on plans:

    a. Indoor Dry and Clean Locations: NEMA, Type 1.
    b. Indoor Damp or Wet Locations: NEMA, Type 4X.
    c. Indoor Corrosive Locations: NEMA, Type 4X Fiberglass
    d. Outdoor Locations: NEMA, Type 4X
    e. Wash-Down Areas: NEMA, Type 4X 316 stainless steel
    f. Other Wet or Damp Indoor Locations: NEMA, Type 4X.
    g. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA, Type 12.
    h. For conditions not addressed above, provide rated enclosures for environmental conditions at installed locations.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel unless indicated otherwise on panel schedule.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components. (Only required with the relative humidity is above 90% and the electrical room or space is not conditioned.)

7. Directory Card: Inside panelboard door, mounted in transparent card holder. All breaker text to be typed and dated. Directory card shall include the source of supply to the panelboard. Directory card shall include typed contact information for the electrical CONTRACTOR.

B. Incoming Mains Location: Top or bottom per CONTRACTOR's installation method unless specifically indicated on the drawings.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Neutral Bus: 100% of the phase bus capacity unless otherwise indicated.
5. Extra-Capacity Neutral Bus (when shown on the drawings): Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
6. Split Bus: Vertical buses divided into individual vertical sections.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs - Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2. Provide SPD devices per Section 26 28 90.

2.03 DISTRIBUTION PANELBOARDS

A. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

F. Branch Overcurrent Protective Devices: Fused switches.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains as shown on the drawings

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Provide Door-in-Door Construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.05 ELECTRONIC-GRADE PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Liebert Corporation.
4. Siemens Energy & Automation, Inc.
5. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1; with factory-installed, integral SPD; labeled by an NRTL for compliance with UL 67 after installing SPD.

C. Doors: Provide Door-in-Door Construction with Secured with vault-type latch with tumbler lock; keyed alike.

D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

F. Buses:

1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
2. Copper equipment and isolated ground buses.

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current 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.
2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I squared x t response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted or Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: as shown on the controls drawings when specifically indicated.
    f. Shunt Trip: as shown on the drawings.
    g. Undervoltage Trip as shown on the drawings.
    h. Auxiliary Contacts: Where shown on the drawings, two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    i. Alarm Switch: Where shown on the drawings, single-pole, normally open contact that actuates only when circuit breaker trips.
    j. Key Interlock Kit: Where shown on the drawings, externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    k. Zone-Selective Interlocking: Where shown on the drawings, integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
    n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 26 49 10 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: When shown on the drawings provide two normally open and normally closed contact(s) that operate with switch handle operation.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting:

C. Floor Mounted panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete in the project specifications. If no concrete is specified use 3000 psi.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

a. Install anchor bolts to elevations required for proper attachment to panelboards.

4. Attach panelboard to the vertical finished or structural surface behind the panelboard.

D. Wall/Rack Mounted:

1. Mount to wall/rack using Unistrut with bolts/mounting hardware approved by the structural ENGINEER or architect.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount panelboards such that the highest operator is less than 78" above finished floor.

G. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

H. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.

I. Install filler plates in unused spaces.

J. Stub a minimum of four 1-inch (27-GRC) empty conduits but not less than 25% of the combined cross-sectional area of the all other live conduit from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub a minimum of four 1-inch (27-GRC) empty conduits but not less than 25% of the combined cross-sectional area of the all other live conduit into raised floor space or below slab not on grade. This is for recessed panelboards only.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

L. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16075 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate City's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 07 50 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 07 50 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

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

B. Perform tests and inspections.

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

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment:

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

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in the "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 48 00
MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all materials, equipment and perform all operations for complete installation of Motor Controllers for use on A.C. circuits rated 600 V or less and related Work as indicated on the Drawings and specified herein, including but not limited to the following:

1. Single Speed Combination Starters.
2. Fractional HP manual.
3. Solid-State reduced voltage controllers.

1.02 REFERENCES

A. All Work and materials shall meet the applicable requirements of all local codes and standards having jurisdiction. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. NECA Standard of Installation (published by the National Electrical Contractors Association).

2. NEMA AB1 - Molded Case Circuit Breakers.

3. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies.

4. NEMA ICS 2.3 - Instructions for Handling, Installation, Operation, and Maintenance of Motor Control Centers

5. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

6. NFPA 70 - National Electrical Code (NEC).

7. UL 486A - Wire Connectors and Soldering Lugs for Use With Copper Conductors.

8. UL 508 - Industrial Control Equipment.

1.03 SUBMITTALS

A. Submit manufacturer's latest published literature for approval .

B. Product data: Submit products data for each product and component specified.

C. Shop Drawings: Submit shop drawings of motor controllers showing accurately scaled equipment locations and spatial relationships to associated motors and equipment.

D. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers showing connections to electrical power panels, feeders, and equipment. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed. Submit comprehensive wiring diagrams of all starters with terminals clearly marked to show proper connection of control wires from temperature control devices and push button stations to starters. Typical or standard wiring diagrams will not be acceptable. Wiring diagrams shall be submitted with the temperature control shop drawings.

E. Maintenance Data: Submit maintenance data and parts list for each motor controller and component; including "trouble shooting" maintenance guide. Include that data, product data and shop drawings in a maintenance manual.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of motor controllers of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing motor controller Work similar to that required for this Project.

C. Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to installation, and construction of motor controllers.

D. Comply with applicable requirements of UL 486A, and UL 508, pertaining to installation of motor controllers. Items provided under this section shall be listed and labeled by UL and shall comply with applicable UL standards.

E. Comply with NEMA ICS 2 and Pub No. 250, pertaining to motor controllers and enclosures.

F. Comply with applicable requirements of ANSI/IEEE Standards.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver motor controllers and components properly packaged in factory-fabricated type containers.

B. Store motor controllers and components in original packaging and in a clean dry space; protect from weather and construction traffic.

C. Handle motor controllers and components carefully to avoid breakages, impacts, denting and scoring finishes. Do not install damaged equipment; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Allen-Bradley Co.
2. Eaton Cutler-Hammer Products.
3. Square D Co.

2.2 MOTOR CONTROLLERS

A. Except as otherwise indicated, provide motor controllers and ancillary components as follows: and as required for a complete installation.

1. Control Power Transformers: Provide a control transformer(s) for each motor controller assembly. Control transformers shall be 480 volts to 120 volts and shall be provided with primary and secondary fused protection. Control transformer sizes shall be as required plus 150VA (minimum) additional capacity.
2. Selector Switches: Selector switches shall be non-illuminated. Switches shall be 30.5 mm, heavy-duty, oil tight, corrosion-resistant, NEMA 4X type. Switches shall have double-break silver contacts. All switches shall be maintained contact type. Provide auxiliary contact blocks as required to meet the requirements outlined in the Description of Operation.
3. Pilot Lights: Pilot lights shall be high intensity, “push-to-test”, LED; single-contact, bayonet-base type. They shall be 30.5 mm, heavy-duty, oil tight; corrosion-resistant NEMA 4 X type. Voltage rating shall be l20 volts, unless otherwise indicated or noted. Color caps shall be red for "Run”, green for “Off”, amber for "Alarm", white for "Open" or “Power On”, and blue for "Closed" or “Maintenance Function Activated” unless otherwise noted.

4. AC Magnetic Interposing Relays - 120 Volts:

a. Power Relays used for inductive load switching / control shall be 120 volt ac magnetic type, shall have convertible contacts and shall be rated for 120 volts inductive, 30 ampere make, 30 ampere break, 20 ampere continuous, with a minimum of 2 DPDT contacts (timing), 4 PDT (non-timing). Acceptable Manufacturers: Cutler - Hammer, Square D, Siemens, Allen-Bradley
b. Control Relays used for interlock control functions to be general purpose, plug-in type construction, 10-amp continuous duty rated, and shall operate on l20 volts AC. Relays shall have terminals which plug-in to a socket, mounted to the inside of the drive enclosure. Contact configuration shall be 3PDT. Provide complete with mating socket base and indicator light to indicate the relay coil is energized. Contact configuration and timing ranges to be as indicated on the Drawings. Acceptable Manufacturers: Equipment Manufacturers identified above or, Potter - Brumfield, Agastat, Syrelec, Idec or Diversified
c. Terminals shall be provided with pressure wire connectors

B. Starters for motors 1/2 hp and over shall be minimum NEMA size #1, full voltage, non-reversing, single or multi-speed type, as required for the motor served designed for 208 volt or 460 volt as indicated, 3 phase, 60 cycle operation of the combination magnetic type.

D. Provide mechanically interlocked enclosure cover to prevent opening the cover unless the breaker is in the "Open" position. The handle shall only be locked in the "Off" position and provisions shall be made to accommodate three (3) padlocks.

E. Starters shall be electrically operated, electrically held, three pole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall be capable of handling eight auxiliary contacts, including the two provided. Overload relays shall be reset from the outside of the enclosure by means of an insulated button. The overload relay shall have a built-in push-to-test button.

F. Combination starter units shall be full voltage non-reversing, unless otherwise noted, and shall utilize motor circuit protectors.. The motor circuit protector shall provide adjustable magnetic protection and be provided with pin insert to stop the magnetic adjustment at 1300% motor nameplate full load amperes. All starter units shall have a "tripped" position on the unit disconnect switch and a push-to-test button on the motor circuit protector. Motor circuit protectors shall include transient override feature for motor inrush current.

G. Single speed combination starters shall be furnished with additional features as follows:

1. Overload protection and under voltage protection or release.

2. Front operated circuit breaker.

3. Provision to automatically disconnect any separate source control voltage so that no hazard exists when working on the interior of the enclosure. This shall be accomplished via a factory installed electrical breaker interlock that will de-energize the magnetic starter when the disconnect is in the "off" position.

4. Electronic overload relays.

5. NEMA type 4X enclosure, or as required to suit location of the starter.

H. Fractional HP Manual Controllers shall be furnished as follows:

1. Single-phase fractional HP manual motor controllers, of sizes and ratings indicated.

2. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Controller shall become inoperative when thermal unit is removed.

3. Provide controllers with double break silver alloy contacts, visible from both sides of controller.

4. Provide pilot light and switch capable of being padlocked-OFF.

5. Provide NEMA Type 4X enclosure suitable for surface or flush mounting coated with manufacturer's standard color finish.

6. Where controllers require an automatic control function, provide "Hand-Off-Automatic" selector switch with Neon pilot light.

L. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.

3. LED indicators showing motor and control status, including the following conditions:

    a. Control power available.
    b. Controller on.
    c. Overload trip.
    d. Loss of phase.
    e. Shorted transistor.
    f. Motor running contactor operating automatically when full voltage is applied to motor.

4. NEMA type 4X enclosure

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which motor controllers are to be installed, and notify Design Professional in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF MOTOR CONTROLLERS

A. Install motor controllers where indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to ensure that products fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A and the National Electrical Code.

C. Provide nameplates for all starters, push button stations and pilot lights. Nameplates shall be lamicoid engraved white letters on black background. Minimum height of letters shall be 1/8". Each motor run pilot light shall be provided with a nameplate indicating "Motor Running".

D. Each enclosure shall be furnished with a schematic wiring diagram pasted on the inside of the door.

E. All magnetic starters interlocked with the temperature control system or other control system shall be of the maintained contact type two wire circuit unless otherwise noted.

3.03 CONNECTIONS

A. Provide equipment grounding connections for motor controller equipment.

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

3.04 DEMONSTRATION

A. Upon completion of installation of motor controller equipment and electrical circuitry, energize controller circuitry and demonstrate that equipment functions in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 71 00
COMMUNICATIONS CABLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Specifications for instrumentation cables

B. Specifications for ProfiNet cables

C. Specifications for ethernet cables

D. Specification for optical fiber cables.

1.03 CITED STANDARDS

A. National Fire Protection Association (NFPA):

1. 70, National Electrical Code (NEC)
2. 70E Standard for Electrical Safety in the Workplace 2012

B. The Institute of Electrical and Electronics Engineers (IEEE)
C. International Society of Automation (ISA)
D. Telecommunications Industry Association (TIA)
E. Underwriters Laboratory (UL)
F. Insulated Cable Engineers Association (ICEA)
G. ProfiNet / ProfiBus Users Organizations

1.04 QUALITY CONTROL

A. The CONTRACTOR shall inspect all materials in the field for compliance with Contract requirements prior to compliance testing with the ENGINEER.

B. The CONTRACTOR shall demonstrate, to the satisfaction of the City's ENGINEER, that materials meet the intent of the Contract Documents.

C. The Integrator shall remove or replace any materials or programming that do not comply with the Contract Documents.

D. All test equipment shall be calibrated in accordance with the manufacturer's written documentation. The CONTRACTOR shall provide acceptable proof of calibration with all test reports.

1.05 ACTION SUBMITTALS

A. Submit in accordance with Section 01 30 00:

1. Product data: for each type of product.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.
C. Standard Test Record Sheets.

1.07 ABREVIATIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. LAN: Local area network.

E. RCDD: Registered Communications Distribution Designer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish network media products as indicated in the contract drawings and specifications.

B. All products shall meet all requirements stated in this specification.

2.02 INSTRUMENTATION CABLE

A. Manufacturers:
1. Southwire
2. Belden.
3. Or approved equal.

B. Flame Rating: LSZH

C. Analog Control Cable

1. Analog signal cable (4-20 mA) shall be 18-gauge twisted shielded single pair tinned copper stranded conductors.
2. The pair shall have a minimum lay of 2 inches per twist.
3. The shield shall be aluminum-polyester with a 20 AWG stranded tinned copper drain wire and an overall Teflon jacket rated at 300 volts.
4. Color code shall be red and black.
5. Cable shall be suitable for plenum, conduit and submerged service.
6. Shields shall be properly grounded at each end.

D. Discrete Signal Wire

1. Soft drawn copper conforming to ASTM Standard B-3.
2. All wire shall be single conductor type unless otherwise indicated.
3. All wire shall be stranded in accordance with ASTM Standard B-8.
4. Instrumentation discrete signal wire shall be a minimum of #14 AWG.
5. Wiring within the panels shall be a minimum of #16 AWG.

2.03 ETHERNET COMMUNICATION

A. Manufacturers:

1. Belden
2. Southwire
3. Or Engineer Approved Equal. All request for substitutions shall be submitted with complete and thorough documentation of equivalency and submitted for approval no less than two weeks prior to bidding.

B. Description: CAT 6, 22awg, UTP (unshielded twisted pair) manufactured in accordance ANSI/TIA/EIA-568-B.2 and ANSI/ICEA S-80-576

C. Ethernet network isolators are required on all ethernet networks.

2.04 OPTICAL FIBER CABLE

D. Manufacturers:

1. Belden
2. Corning
3. Or Engineer Approved Equal. All request for substitutions shall be submitted with complete and thorough documentation of equivalency and submitted for approval no less than two weeks prior to bidding.

E. Description: Multimode, 62.5/125 micrometer, 6 count minimum, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA-492AAAA-A for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

    a. General Purpose, Nonconductive: Type OFN or OFNG
    b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.

5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

F. Jacket:

1. Jacket Color:

    a. Orange for 62.5/125-micrometer cable.

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

G. Fiber optic connectors shall be ST type unless otherwise noted.

PART 3 - EXECUTION

3.01 GENERAL

A. Provide all labor, materials, field-test instruments and equipment required to complete the installation, testing and commissioning of the required Network Media in accordance with the contract documents

B. In order to conform to the overall project schedule, the CONTRACTOR shall survey the work area and coordinate cable testing with the other applicable trades.

END OF SECTION

SECTION 26 90 00
CONTROL SYSTEM INTEGRATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Requirements for the CONTRACTOR to provide a Control System Integrator (CSI) who shall be responsible for integrating the existing and proposed equipment, material, and software into a fully operational control system.

B. Requirements specific to the CSI and specific integration work associated with the contract plans and specifications.

C. CSI shall be responsible for the coordination, supply, and testing of the following:

1. Section 26 91 00 “Control Panel Construction”
2. Section 26 93 00 “Functional Control Description”
3. Section 26 95 00 “Field Instruments”

1.02 CITED STANDARDS

A. National Fire Protection Association (NFPA):

1. 70, National Electrical Code (NEC)
2. 70E Standard for Electrical Safety in the Workplace

B. The Institute of Electrical and Electronics Engineers (IEEE)

C. International Society of Automation (ISA)

1.03 INTRODUCTION

A. The Control System Integrator may also be referred in this contract as the Integrator or the CSI.

B. The CSI shall be responsible for supplying the control systems equipment and communication capability detailed in contract documents. Equipment shall include

instrumentation, PLC, OIT, control panels, panel wiring, interconnections between panels, panel devices and communications equipment. The responsibilities of the CSI shall also include programming services and software development for PLC, OIT, and communication systems. Additionally, the CSI shall provide detailed designs, testing, validation, quality assurance/quality control, calibrations, settings, control systems maintenance, and training as associated and required within the scope of work.

1.04 OVERVIEW OF INTEGRATOR'S SCOPE

A. The intent of the work shall be in accordance with the contract drawings, specifications, terms of reference, applicable codes, existing documents, and any applicable listings.

B. The control system shall include but not be limited to: monitoring, control, data acquisition, communications, and networking.

C. The Integrator's scope of work is to include but not necessarily be limited to:

1. Perform discovery work as required for implementing further detailed design to meet the requirements detailed herein.
2. Supply and install of materials and equipment.
3. Provide detailed design as described.
4. Coordinate activities with other divisions to ensure complete and fully operational systems are provided.
5. Coordinate with manufacturers as applicable to interface with manufacturer's panels.
6. Provide new control panels in accordance with Contract Drawings and Specifications.
7. Ensure all devices and components are set, tested, and calibrated for proper operation.
8. Develop new software applications for PLC control logic as described in the Contract Documents.
9. Develop graphic displays in the OIT for booster pump station control process.
10. Provide drawings and submittal documents as listed in this Section.
11. Perform factory acceptance testing (FAT), commissioning, and site acceptance testing (SAT) for control systems.
12. Schedule and provide operator training.

C. The Integrator shall provide a detailed design and programming of the PLC control logic elements defined in the contract documents.

E. The Integrator shall include an additional 160 manhours in their price as an allowance for programming as directed by the ENGINEER in the field. This will only be used as directed by the ENGINEER.

F. The Integrator shall install and configure communication equipment.

G. The Integrator shall be required to meet minimum qualification levels as defined herein.

H. The Integrator shall assume responsibility and maintain equipment identified for upgrade or replacement in the Contract Plans and Specifications during the project period.

I. The Integrator shall adhere to national and local code requirements for installation and commissioning.

J. The CONTRACTOR and CSI are required to install all wiring, piping, conduits and necessary mounting hardware and accessory equipment to provide a complete and fully operational control system as indicated in the Contract Plans and Specifications.

1.05 SPECIAL PROJECT PROCEDURES

A. The Integrator is to consider the following special conditions that apply in addition to conventional project procedures as follows:

1. The Integrator must ensure protection of the existing operating controls during construction by properly backing up the existing system prior to construction if restoration is required.
2. Access is limited to typical business hours and access beyond normal business hours must be coordinated with the CITY.
4. The Integrator shall protect all supplied equipment against damages and replace any failures during the entire project period.

1.06 QUALITY CONTROL

A. The CSI, working under the direction of the CONTRACTOR, shall implement quality assurance and control measures to include the following:

1. Factory Acceptance Test (FAT) procedures.

a. The Factory Acceptance Test (FAT) shall allow the Integrator to demonstrate simulated operation and functionality of the control system to the CITY and ENGINEER prior to delivery and installation. Notify CITY and ENGINEER two weeks in advance

to allow for attendance during FAT testing in accordance with Section 26 99 10.

b. The Integrator shall provide all hardware and software for simulation.

2. Installation and Commissioning Procedures

a. The Integrator shall follow installation and commissioning Procedures to reduce risk and to safeguard personnel and equipment during installation.

b. These procedures shall be conducted in accordance with Section 26 99 20.

4. Site Acceptance Test (SAT) procedures.

a. The SAT shall allow the Integrator to demonstrate and document proper operational readiness and functionality of the control system, to the CITY and ENGINEER after installation and on-site I/O checkout.

b. Include site system integration into City's overall control system and verify functionality within City's remote operations system.

c. The SAT shall be conducted in accordance with Section 26 99 30.

B. To ensure quality, all components shall be UL listed or certified by an approved NRTL.

1.07 SUBMITTALS

A. Provide all submittals in accordance with Section 01 30 00.

B. Shop Drawings and Product Data

1. As part of the requirements of this section of the specifications, the CONTRACTOR shall provide shop drawings and descriptive literature of the control system package for the ENGINEER's review. No fabrication, programming, or installation of any control system equipment shall take place without such review. No partial shop drawing submittals will be accepted.

2. Shop drawings for the control system shall be submitted in accordance with the requirements of the general requirements of these specifications. Shop drawings for the control system shall include, as a minimum, the following:

a. Elementary wiring diagrams and panel elevations for control panels.

b. Control schematics for equipment.

c. Interconnection wiring diagrams detailing wiring or cabling to the field devices, sensors, or instruments as well as network or other communication cables necessary for integration.
d. Manufacturer's Data Sheets with complete model numbers and any applicable manufacturer's recommended practices for the equipment.
e. Software data sheets. Complete software descriptions and version numbers shall be provided for review and approval.
f. Diagram of the control system communication architecture. The diagram shall show all hardware and communication components.
g. Screenshots or diagrams of all proposed graphic display screens for the OIT.

C. Integration services to design, program, install, commission, and test the booster pump station control system, sodium hypochlorite storage and communication configuration for remote access to monitoring data.

C. Final Documentation

1. Shop Drawings and Product Data:
2. As part of the requirements of this section of the specifications, the CONTRACTOR shall provide shop drawings and descriptive literature of the control system package for the ENGINEER's review. No fabrication, programming, or installation of any control system equipment shall take place without such review. No partial shop drawing submittals will be accepted.
3. Shop drawings for the control system shall be submitted in accordance with the requirements of the General Requirements of these Specifications. Shop drawings for the control system shall include, as a minimum, the following:
4. Elementary wiring diagrams and panel elevations for control panels.
5. Control schematics for equipment.
6. Interconnection wiring diagrams detailing wiring or cabling to the field devices, sensors, or instruments as well as network or other communication cables necessary for integration.
7. Manufacturer's data sheets with complete model numbers and any applicable manufacturer's recommended practices for the equipment.
8. Software data sheets. Complete software descriptions and version numbers shall be provided for review and approval.
9. Diagram of the control system communication architecture. The diagram shall show all hardware and communication components.
10. Screenshots or diagrams of all proposed graphic display screens for the OIT.

PART 2 – PRODUCTS

2.01 TRAINING

A. The CONTRACTOR shall provide familiarization training to the operations personnel after completion of the SAT. The CONTRACTOR shall coordinate with CITY for availability of operators to schedule training.

B. The training shall consist of the following:

1. New equipment familiarization and troubleshooting.
2. OIT Training.
3. Trouble-shooting procedures.

2.02 WARRANTY FOR INTEGRATION SUPPORT

A. The warranty shall be one year from the date of substantial completion.

C. The warranty period shall provide the following:

1. Replacement of any newly installed equipment for 1 year.
2. Software and application programming support to correct any errors or omissions in control logic, graphic displays in the OIT, communication configuration for remote access.
3. A block of 40 hours of Integrator support time to be used at the CITY's discretion to make enhancements or changes to the PLC or graphics.

    a. This block of time may be used in non-contiguous blocks of 4 hours.
    b. The time may only be used for offsite programming and remote support/ troubleshooting.
    c. Any unused time will expire after the 1-year warranty period.
    d. On-site time, direct expenses, or additional time must be coordinated and contracted separately from this contract between the CITY and the Integrator.

PART 3 – EXECUTION

3.01 CONTROL SYSTEMS INTEGRATOR (CSI)

A. The Integrator shall:

1. Be responsible for integrating the existing and proposed equipment, material, and software into a fully operational control system.
2. Work directly for the CONTRACTOR involved with the installations.

3. Provide integration and supply of controls related hardware and software shown on the design drawings to include, but not limited to:

    a. PLC equipment
    b. Control panel equipment
    c. Cable and wiring for a complete functional control system
    d. Communication equipment for wireless cellular communication
    e. Overseeing terminations and testing of wiring to PLC, I/O, sensors, control and monitoring panels, control elements, another systems interface, OIT and communications system.
    f. Terminal boxes as required.
    g. Required PLC and OIT application software
    h. Miscellaneous items required for a fully operational control system.

4. Provide and install all software development for this project. This software shall include but not be limited to the following:

    a. PLC application software
    b. PLC Control Logic application code
    c. OIT application software
    d. OIT graphic displays
    e. Reporting applications
    f. Database configurations
    g. Miscellaneous software as required to produce a fully operational control system.

5. Configuration of wireless cellular communication equipment.
6. Remote access configuration and written procedure for accessing data from remote location.
7. Provide record documentation as specified in Section 26 90 00.
8. Provide training as specified in Section 26 90 00.

3.02 CONTROL SYSTEM INTEGRATOR QUALIFICATIONS

A. The Integrator shall have at least 10 years of experience in water and wastewater control systems or be one of the following:

    1. Approved provider submitted no less than four weeks prior to bid for evaluation and approval by City and Engineer.

B. The Integrator's staff shall meet the following requirements:

1. Programmers:

    a. Lead Programmers shall be graduate engineers or computer science majors with a 4-year college degree.
    b. Team programmers shall have a minimum of a 2-year associate degree in a field related to computers or electrical maintenance.
    c. As a minimum, all programmers shall have a minimum of 10 years of experience in industrial PLC and HMI programming for water or wastewater systems.

2. Field Service Technicians:

    a. All service technicians shall have a minimum of a 2-year associates degree in a field related to computers or electrical maintenance.
    b. All service technicians shall have a minimum of five years of experience in PLC systems and HMIs.
    c. All service technicians shall be capable of programming minor edits in the project PLC's and uploading or downloading PLC applications.
    d. All service technicians shall have experience troubleshooting: motor starters, PLC's, computers, HMI systems, and basic electrical controls.
    e. Service technicians shall show proficiency in using the following equipment: volt meters, PLC programming software, HMI configuration tools.

END OF SECTION

SECTION 26 91 00
CONTROL PANEL CONSTRUCTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Requirements for the CONTRACTOR to furnish and install control panels referenced on the Contract Drawings and specified herein.

B. Control panel fabrication shall be performed by a UL Panel Fabrication shop.

C. Control panels shown or described in the Contract documents are diagrammatic in nature and may not depict all required components necessary. This in no way limits the CONTRACTOR'S responsibility to provide a complete and fully functional system as required to operate the facility according to these specifications.

D. Control panels to be furnished and installed are as follows:

1. Pump Control Panels

    i. CP-TP
    ii. CP-HCL

2. Motor Starters for all pumps.

1.03 RELATED SECTIONS

A. Division 26
B. General and Special Provisions of the Contract.

1.04 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

B. Occupational Safety & Health Administration (OSHA)

C. The Institute of Electrical and Electronics Engineers (IEEE)

D. International Society of Automation (ISA)

E. Building Industry Consulting Service International

F. Telecommunications Industry Association (TIA)

G. Underwriters' Laboratories, Inc. (UL)

H. National Electric Manufacturers Association (NEMA)

I. American National Standards Institute (ANSI)

1.05 NOTED RESTRICTIONS

A. The "Delegate" ENGINEER of Record for the Control System shall be responsible for the detailed design of all custom-built control panels based on the information contained in the drawings. In addition, the "Delegate" ENGINEER of Record for the Control System shall be responsible for all interconnection and loop drawings associated with the custom-built control panels.

1.06 QUALITY CONTROL

A. The control panel components shall be of the most current and proven design. Specifications and Drawings call attention to certain features but do not purport to cover all details entering into the design of the control panels. The components provided by the Control Panel Builder shall be compatible with the functions required and shall form a complete working system.

B. The entire control system shall bear a UL 508A serialized label "Enclosed Industrial Control Panel". The use of the label "Industrial Control Panel Enclosure" without the UL508A serialized label is not acceptable.

1.07 SUBMITTALS

A. Shop drawings shall include at a minimum the following:

1. Catalog information and descriptive literature of all components, wiring diagrams, and panel layout drawings showing dimensions to all devices.

2. Loop diagram and field wiring diagrams for each control panel.
3. Network installation drawings/schematics related to the panel.
4. Material test certifications and manufacturer's material certifications.
5. Heat load calculations for equipment containing active electronic components.
6. Power supply load calculations
7. CONTRACTOR's installation methods, equipment, materials, and product data.
8. Material Safety Data Sheets (MSDSs) for all materials to be used to meet the requirements of this section.

1.08 SPARE PARTS

A. Spare parts shall be furnished for each pump station including but not limited to the following:
   1. One (1) spare SD memory card for each type provided
   2. One (1) spare I/O modules for each type provided
   3. 10% spare fuses of each type provided but not less than two of each type.
   4. 20% spare I/O within installed I/O modules by the panel fabricator
   5. 10% spare terminal blocks (preinstalled by the control panel fabricator)
   6. One (1) spare indicator light for each type provided
   7. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.
   8. Where indicated or requested by the CITY, provide a lockable steel cabinet sized based on the spare parts provided plus 20% spare capacity for City's use. Indoor conditioned space cabinets shall be NEMA 1. Indoor unconditioned space cabinets shall be NEMA 12.

1.09 WARRANTY

A. The CONTRACTOR shall provide a manufacturer's warranty covering the full replacement of all equipment specified within this section. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from substantial completion.

PART 2 - PRODUCTS

2.01 CONTROL PANEL

A. The completed control panel assembly shall be manufactured by a qualified control panel builder.

B. The control panel enclosure shall be designed and sized in accordance with the requirements of the Drawings and as specified herein. The control panel enclosure shall be manufactured by Hoffman or ENGINEER approved equal.

C. Control panel enclosures located in unconditioned spaces or outside shall be NEMA, 4X, 0.125-inch marine grade aluminum or 316L SS. Panels located in areas corrosive to Aluminum or SS shall be NEMA 4X, FRP. Panels shall be equipped with the following:

a. Piano type hinged, overlapping doors with neoprene gasket. Doors shall be equipped with a heavy-duty 3-point latching mechanism operated by a padlocking handle.
b. Following fabrication, the control panel shall be degreased and cleaned. Stainless steel panels shall also be treated with a phosphatizing process.
c. All panels shall have continuously welded seams.
d. Panel enclosures shall be equipped with aluminum sun shields of the same grade and thickness material as the panel. Sunshields shall be mounted with 1.5 inch of separation from the panel, in a manner that maintains the NEMA rating of the panel.
e. Panels shall be constructed with thermostatically controlled anti-condensation space heaters.
f. The maximum size of an aluminum enclosure shall be no taller than 60-inch wide or 60-inch high with 12-inch floor stands for a total height of 60-inch. Any enclosure that requires a larger size shall be 316 SS.
g. Aluminum enclosures with free standing bases shall have the bases manufactured out of 316 SS, to give extra strength.

D. Panel Finishes

1. Marine Grade Aluminum: Factory finished immediately after cleaning and pretreating with manufacturer’s standard two-coat, baked-on finish consisting of prime coat and thermosetting polyester powder topcoat. The inside of the panel shall be white, and the exterior shall be white.
2. Carbon Steel: Factory finished immediately after cleaning and pretreating with manufacturer’s standard two-coat, baked-on finish consisting of prime coat and thermosetting powder topcoat. The inside of the panel shall be white, and the exterior shall be white.
3. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

E. Hardware / Fasteners:

1. All Hardware and Fasteners shall be 316 stainless steel.
2. All mounting screws shall be drilled and tapped; no self-tapping screws are allowed.

F. Provide a plastic data pocket in the control panel. Data pocket shall be attached to the lower portion of the enclosure door or the lower right door of two door models.

G. Instrumentation Wire

1. Cable for 4-20mA analog instrumentation circuits shall be multi-conductor twisted, tinned, 18 AWG, with a FOIL and BRAIDED shield.
2. Insulation is to be stripped back 6-inch from the terminal connection to allow clamp on measurement of 20ma loop.

H. Discrete Signal Wire

1. Cable for 24VDC to 120VAC discrete signal control circuits shall be minimum #16 AWG stranded ASTM Standard B-8.
2. Insulation is to be stripped back 6-inch from the terminal connection.

2.02 PANEL MOUNTED DEVICES

A. Enclosure Door Switches

1. Provide door switches on the enclosure doors for remote indication that the door is open.
2. The door switch shall be comprised of a microswitch with a swing-arm activation mechanism.
3. Enclosure door switches shall be manufactured by Eaton, Siemens, Hoffman, or ENGINEER approved equal.

B. Control Circuit Breakers

1. Control circuit breakers shall be of energy-limiting design and field-mountable for selective applications.
2. Circuit breakers shall mount on a DIN rail.
3. Control Circuit breakers fed by an integral Control Power Transformer shall have a UL/CSA Rated Interrupt Capacity of 10,000 A.

C. Surge Protection Devices

1. The Control Panel will have a minimum Type 2 SPD with a surge capacity of 40 kA at 8 x 20 us or above.
2. All surge protection devices shall be monitored by a discrete input to the PLC.
3. The surge suppression listed in TABLE 1-1 are all approved for the application listed.

TABLE 1-1: CITEL Surge Arrestors

Part Number	Application
DLAW-24D3	Analog
MJ8-CAT5E	Ethernet
DS220S-24DC	24VDC
DS41S-120	120 VAC Surge
DS42S-230	240 VAC

D. Volt DC Power Supplies

1. Provide a Power supply for 24Vdc power
2. UPS – Station Control Panel SCP-1 Only

    a. All control devices such as PLC, HMI and other such devices shall be on its own UPS.
    b. Provide a second UPS for 24Vdc power for control device communications power.

3. 24-Volt DC power supplies shall be mounted in control panels to supply 24-Volt DC power for the programmable controller inputs and for the 2-wire instrumentation and for 4-Wire instrumentation and communications power.
4. The power supplies shall be sized as required plus 25% spare capacity. Load calculations shall be provided with the control panel shop drawing submittal.
5. Provide a redundancy module for the power supplies.
6. The 24-volt DC power supplies shall be manufactured by:

    a. SOLA
    b. Phoenix Contact

7. Grounds common and power for each electrical device shall have its own wire connected to one central distribution. Daisy chained shall not be accepted.

E. Selector Switches

1. Selector switches shall be 30.5 mm, heavy-duty, and non-illuminated.

2. Switches shall have double-break silver contacts and shall be maintained contact type unless otherwise indicated on the Drawings. Auxiliary contact blocks shall be provided on switches where indicated on the Drawings or in the Description of Operation.
3. Selector switches shall carry the same NEMA rating as the panel on which installed.
4. Provide a white legend plate for each switch with black engraving as indicated on the Drawings.
5. Selector switches shall be manufactured by:

    a. Rockwell (Allen-Bradley)
    b. Square D
    c. or ENGINEER approved equal

F. Push Buttons

1. Push buttons shall be 30.5 mm, heavy-duty, non-illuminated.
2. Push buttons shall have double-break silver contacts, momentary contact type and shall be color-coded as indicated on the Drawings. Push Buttons without a color indication shall be black.
3. Push buttons shall carry the same NEMA rating as the panel on which installed.
4. All push buttons shall have flush heads unless otherwise indicated on the Drawings.
5. Provide a white legend plate for each push button with black engraving as indicated on the Drawings.
6. Selector switches shall be manufactured by:

    a. Rockwell (Allen-Bradley)
    b. Square D
    c. or ENGINEER approved equal

G. Pilot Lights

1. Pilot lights shall be 30.5 mm, heavy-duty, push to test, with universal LED lamps. Lens color shall be as indicated on the drawings.
2. Pilot lights shall carry the same NEMA rating as the panel on which installed.
3. Provide a white legend plate for each pilot light with black engraving as indicated on the Drawings.
4. Selector switches shall be manufactured by:

    a. Rockwell (Allen-Bradley)
    b. Square D

c. or ENGINEER approved equal

H. Relays, General Purpose

1. General purpose relays as shown on the drawings shall be UL labeled, industrial grade as manufactured by:

    a. Allen Bradley
    b. Phoenix Contact

2. Relays shall have LED indication of energized/de-energized state.
3. Relays shall have latching Levers.

I. Interposing Relays – Used with PLC I/O

1. Interposing relays shall be miniature industrial type with 120 VAC coils or pluggable miniature type for 24 VDC coils.
2. Relays shall have LED indication of energized/de-energized state.
3. Relays shall be SPDT or DPDT type with AgNi contacts rated for 6A resistive minimum.
4. Interposing relays shall be manufactured by:

    a. Allen Bradley
    b. Phoenix Contact

J. Fuses

1. All fuses shall be sized as required for the circuit they are protecting.
2. Fuses shall be rated at 600 VAC/170 VDC (1/2-20 A) and 480 VAC/300 VDC (25 – 60 A).
3. Fuses shall be listed UL Std. 248.
4. Fuses shall be supplied with manufacturer recommended fuse blocks.
5. Fuses shall be manufactured by:

    a. Cooper Bussman, Inc.
    b. Ferraz Shawmut, Inc.
    c. Littlefuse, Inc.
    d. Edison Fuse, Inc.
    e. or ENGINEER approved equal

K. Terminal Blocks

1. Terminal Blocks shall be by:

    a. Phoenix Contact
    b. Or approved equivalent

2. The minimum size shall be 4mm.
3. Terminals colors are to match UL508A voltage color code
4. All field wiring shall land on din-rail mounted terminal blocks near the bottom of the control panel prior to distribution within the control panel.
5. All spare I/O shall be brought out to terminal blocks for future use.
6. Like devices, equipment, or signals shall be grouped together on terminal blocks. Terminal block layout shall provide for future expansion without the need for renumbering.
7. All terminal blocks shall be rated for 600 volts AC and shall be identified with a permanent machine printed marking.
8. A maximum of two (2) wires shall be provided per terminal block.
9. Field signal terminal blocks:

    a. 24Vdc Fuse modular terminal block - UKK 5-HESILED 24 (5X20) - 3026654
    b. 120Vac Fuse modular terminal block - UKK 5-HESILA 250 (5X20) - 0711629

10. For multiplex signal terminal blocks:

    a. 120v Four-conductor universal terminal block - UT 4-QUATTRO RD - 3074460
    b. 24v Feed-through terminal block - UT 4-QUATTRO BU - 3044584

11. Feed through terminal blocks:

    a. UT 4-QUATTRO - 3044571

12. For Isolation or disconnect terminal blocks:

    a. Single level knife disconnect terminal blocks - UT 4-QUATTRO-MT-3064043
    b. Double level knife disconnect terminal blocks - UTTB 4-MT - 3044775

13. Analog signal (Input and Output) terminal blocks:

    a. Fuse modular terminal block - UT 4-PE/L/HESILED 24 (5X20) - 3214321

L. Wiring

1. Type and Identification

    a. All Wire Colors in the panel are to follow the UL508A standards.
    b. Control Wiring shall be numbered / lettered at each end. Wire numbers / letters shall be Flattened Polyolefin Heat Shrink Markers for Permanent Wire and Cable Identification (Panduit) or JEA approved equal.

2. All interior control panel control wiring shall be stranded copper #18 AWG, 600V, Type RHW2.
3. All interior control panel analog signal wiring shall be 18 gauge, twisted-shielded pairs with foil shield and drain wire. Analog signal wire shall be manufactured with 600V, 75° insulation.
4. All wiring and terminal strips shall be isolated by voltage levels to the greatest possible extent.
5. Wiring shall be continuous with no splices.
6. Exterior panel wiring shall be as indicated on the Drawings.

M. Wiring Duct

1. Wiring Duct shall be as follows

    a. Panduit Wide Slot with a Hinged Cover. Non hinged covers will not be accepted.

2. Wiring Duct is to have a maximum fill limit of 40%.
3. The outside edge of the Panduit can be placed no closer than 2 inches to the nearest terminal edge or component. This is to allow adequate space to wire the terminals.
4. Wire Duct installed on the outside edges of the back panel must be a minimum of 2 inches from the edge of the back panel.

N. Grounding Bus

1. Provide a copper isolated grounding bus inside the control panel for terminating all ground wires.
2. Grounding busses shall be 2-inch x ¼-inch x 12-inch long and manufactured of copper. Grounding busses used for isolated grounds shall be provided with a standard hardware kit that includes fixtures for isolation from the panel. The installation kit shall include at least one #2 compression lug.
3. Grounding busses shall be manufactured by:

    a. Cooper Industries (SBTGBK)
    b. Panduit
    c. Eritech
    d. or ENGINEER approved equal

O. Nameplates

1. Nameplates are to be provided for all individual panels, instruments and panel mounted devices.
2. Use plastic laminate nameplates having engraved black letters on a white background.
3. Letters must be a minimum of 24 Font.
4. Nameplate must be visible when devices are wired

P. Programmable Logic Controllers

1. PLC system shall be Rockwell, Allen Bradley Micro 800 series.
2. Provide a complete PLC system with processors, communication modules, local and remote I/O modules and other system components as shown on the Drawings. All PLC hardware components shall be configured to perform the functions shown on the Drawings and within these specifications.
3. The PLC shall be suitable for use under the following environmental conditions:

    1. Operating temperature: 0°C to 60°C for horizontal configuration
       0°C to 40°C for vertical configuration
    2. Relative humidity: 95% at 25°C, non-condensing

5. The PLC or Distributed I/O shall be provided with approximately 20% spare I/O points.

    a. All spares are to be wired to terminals

6. The CONTRACTOR shall provide all Ethernet switches, adapters, connectors, and interconnection cables necessary to connect the PLCs to the network. Network isolators shall be required on all ethernet based networks originating from field devices outside of the main pump building.
7. Analog Input modules shall be isolated from the backplane and each channel shall be individually isolated from each other.
8. Each Input module shall have two fuses to divide the inputs
9. Maximum I/O per card shall be as follows:

    a. Discrete Input - 16
    b. Discrete Output - 16
    c. Analog Input - 8
    d. Analog Output -8

Q. Operator Interface Terminals (OITs)

1. OITs shall be Manufactured by Allen Bradley and shall be (PanelView), or Engineer Approved Equivalent.
2. OITs shall have at a minimum a 10-inch, high resolution, touch screen, color display with Ethernet connectivity
3. Includes Logix-based alarms to eliminate need for additional configuration
4. Achieves <100 ms response for machine jogging applications with a high-speed HMI button
5. Provides Logix tag extended property support to help develop richer context
6. Features a modern design with a slim bezel
7. Allows for the ability to create custom, re-usable add-on graphics to more efficiently build your applications
8. Shares tags, alarms, and other data using Studio 5000 View Designer™ environment automatically
9. Offers emulator to test run a project without downloading to a physical terminal
10. Uses a built-in VNC server to support a remote VNC client for monitoring and troubleshooting
11. Units shall be UL Listed.

R. Communication Networks

1. Communications shall be capable of using Ethernet/IP and OPC protocols.
2. The PLC shall be capable of peer-to-peer communications that provide for the direct transfer of process data between controllers without the use of gateways or servers.

3. PLC chassis shall be capable of containing one or more communication modules to provide communication interfaces to other devices, including, but not limited to: remote workstations, HMIs, and PLCs by other manufacturers. As a minimum, the PLC shall support the following without the need for third-party modules:

    1. Ethernet (10/100MB).
    2. Serial protocols including Modbus and ASCII.

S. Auto Dialers

Auto Dialers shall be manufactured by RACO Manufacturing and Engineering Co. and be Verbatim model with the Cellularm option included.

Standard Specifications: Electrical

1. Power requirement:105-135 VAC, 50/60 Hz, 15 watts maximum or 8-14 VDC at 500 mA maximum.
2. Battery charging: Precision voltage controlled, including automatic rapid recharge after drain. Battery backup: 20 hours
3. Input sensing: Four unpowered contact inputs standard. Open contacts 5 volts DC; closed contacts see 10 ma DC.

T. PHYSICAL

1. Surge protection: Integral gas tube and solid-state protectors on all phone, power, and signal lines. Accommodates field-installed upgrades. Rugged metal indoor enclosure.
2. Temperature range: 20˚ to 130˚F.
3. Humidity: 0 to 95%, noncondensing.

U. TELEPHONE

1. Rotary pulse or tone dialing, keyboard selectable
2. Dials up to 16 different numbers, each up to 60 digits long.
3. Allows programming of PBX delays in 1 second increments.
4. FCC Registered Part 68, “Ringer Equivalence”: 0.3A.
5. Alarm Acknowledgement is by Touch-tone key or by calling back.
6. Built-in speaker phone allows two-way conversation
7. Compatible with most cellular telephone systems. SPEECH MESSAGES
8. Users record their own messages. Also includes resident vocabulary for programming guidance and for default “alarm/ normal” speech if no user messages are recorded.

V. MODULAR OPTIONS

1. Analog. Custom scaled in the units of measurement required for your job. Analog alarms on a high and a low alarm setpoint. Upgradeable to 1, 4, 8 or 16 analog channels. Remote Supervisory Control. The operator can turn equipment on or off via any telephone. Upgradeable to 4 or 8 outputs.

2. Channels. Upgradeable to 8, 16, 24 or 32 contact channels.
3. Modbus Interface. In addition to physical inputs, the unit is upgradeable to 32, 64 or 96 additional alarms of any type via RS232 and Modbus RTU master protocol.
4. Cellular Telephone. Cellularm™ System provides temporary or permanent alarm autodialing over the cellular telephone network when conventional telephone lines are disabled or unavailable. Furnished in a rugged, weather-resistant housing that's easy to transport and set up.

W. FACTORY OPTIONS

1. Enclosure. System available in NEMA 4X enclosure, which is corrosion proof and sealed against 12 feet of water.
2. Environmental. Thermostatically controlled heater available, suggested for operation below 20˚F or where condensation may occur.
3. Local Alarm Relay Output. Relay activates during unacknowledged alarm conditions. Secure Front Panel. Verbatim System furnished without front panel programming controls and indicators. Restricts access to unsupervised or remotely located units, as well as reducing the initial purchase price.

PART 3 – EXECUTION

3.01 PREPARATION

A. Factory acceptance testing shall be in accordance with Section 16991. Testing shall occur at the panel fabricators facility or a facility chosen by the CSI. CSI shall coordinate all testing requirements, notifications to CITY and ENGINEER, and reporting results. CSI or panel fabricator shall prepare a FAT testing protocol document and submit to the CITY and ENGINEER for review and approval at least 3 weeks in advance of planned FAT testing.

B. Start-up and Testing

1. Check the panel for conformity with the approved shop drawings for the panel being supplied.
2. Provide a minimum of 16 hours for onsite support to be used at the direction of the CITY or ENGINEER for field required modifications to the control panels.
3. Test the operation of the control panel and all controls.
4. Test the operation of all communication equipment.
5. All start-up and testing shall be performed in the presence of City and the ENGINEER.

6. Any field revisions to the control panels shall be documented and incorporated into final O&M manuals. Additionally, shop drawings shall be updated and resubmitted to the ENGINEER for record keeping purposes.

C. Training

1. Provide up to 16 hours of training for the CITY's personnel on the operation of the control panel.
2. Training shall be provided on at least two separate days and two separate shifts, as necessary, to accommodate personnel on all work schedules and shifts.
3. Training shall include operation of the controls and troubleshooting procedures.

END OF SECTION

SECTION 26 91 10
CONTROL PANELS, ENCLOSURES AND DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish, install, test and place in satisfactory operating condition, control panels, equipment enclosures and associated devices as indicated in the Specifications, and as shown on the Contract Drawings. The term enclosures shall apply to both equipment enclosures and control panel enclosures. All control panels and equipment enclosures shall be designed, assembled and furnished by the controls supplier. The equipment shall be installed by the Contractor in accordance with the specifications, manufacturer's recommendations, Contract Drawings and best industry practice, together with all wiring, terminations, etc. to interface all instrumentation and controls, as required. Panels and enclosures shall be installed under the direct supervision of the controls supplier. Mounting equipment such as brackets, stands, hardware and appurtenances shall be provided as required.

B. This Section describes the requirements for all control panels and equipment enclosures housing control and instrumentation equipment, PLC, I/O and network hardware, operator interface terminals, wiring, terminals, etc. supplied for this contract, and the following:

1. Control Panel Fabrication.
2. Equipment Enclosures.
3. Control Panel Equipment and Devices.

1.02 RELATED SPECIFICATIONS

A. All work of this Division shall meet the requirements of the following related Sections and Divisions.

1. Specification 23 05 53 - Testing, Adjusting, and Balancing.
2. Specification 23 91 00 – HVAC I&C Devices.

1.03 REFERENCES

A. All equipment and services provided herein shall be in accordance with the references stated in Division 11.

1.04 SUBMITTALS

A. Submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of Division 1.

B. The Contractor shall submit the following items as a minimum for review and approval by the Engineer:

1. Detailed fabrication drawings of all equipment provided under this Section. Drawings shall show materials; all dimensions both internal and external; internal equipment layout, dimensions and spacing; power input and wiring terminal locations; mounting location, heights, finishes and installation details.
2. Detailed data sheets, installation manuals, instruction and operation manuals, manufacturers literature, options and all other pertinent information for all equipment provided under this Section.
3. Complete schematic wiring diagrams and internal point to point wiring diagrams for all units.
4. Factory and field testing procedures and certified results.

1.05 SPARE PARTS AND SPECIAL TOOLS

A. Provide all of the individual manufacturers recommended spare parts and tools for all equipment specified herein. In addition to the recommended spares, furnish all of the following minimum spare parts, tools and devices. Spare parts and special tools shall be provided in accordance with the requirements of Division 1.

1. General
    a. Provide 20% (minimum of 10) spare fuses, lamps for indicating lights, etc., for each size and type provided.
2. Relays, Circuit Breakers, Fuse Holders, etc.
    a. Provide 10% (minimum of 2) spares of each size, type and configuration for each 10 or part thereof installed.
3. Panel Mounted Switches, Push Buttons and Indicating Lights
    a. Provide 10% (minimum of 2) spares of each size, type, color and configuration for each 10 or part thereof installed. (Including contact sets)
4. Terminals and Mounting Strips
    a. Provide (20% minimum of 10) spares of each size, type and configuration for each 10 or part thereof installed. (Including mounting rail)
5. Specialty Items Not Listed
    a. Provide 10% (minimum of 2) spares of each size, type and configuration for each 10 or part thereof installed.

1.06 SHIPPING AND STORAGE

A. Each panel shall be identified with purchaser's complete order number and tag number on a metal tag securely wired to the panel. Each component requiring identification for proper assembly shall be tagged separately.

B. Panel shall be so packaged and packed that, with customary handling, it will be protected from damage in shipment. Each shipping section shall be mounted on skids.

C. Before packing, all equipment shall be clean and dry.

D. All electrical wiring leads between panel sections shall be clearly marked for reassembly, and shall be coiled and rigidly held within the panel framework.

E. Special handling instructions shall be conspicuously placed on all equipment requiring unusual handling and shipping care.

F. In general standard panel instruments such as indicators, which can be damaged during transit shall be removed and shipped separately.

G. When equipment is transported to the job site by ship, the following shall apply:

1. All equipment shall be shipped as below deck cargo.

2. Whenever practicable, panels shall be bolted to container frames. All exposed tubing, wiring, and instruments shall be protected by padding. Containers shall be lined with water proofing materials.

3. Instruments shipped separately shall be packed in moisture-proof containers with a desiccant and held in a fixed position with packing.

4. Crates and boxes shall be reinforced with steel straps. Crates and boxes with a net weight in excess of 400 lbs. shall have diagonal bracing on all faces. When net weight is in excess of 500 lbs., skids shall be bolted to the container frames.

H. All equipment, once assembled, whether stored at the factory, on site or at a remote location, shall be kept protected and free from damaging environmental conditions. Unless otherwise specified, equipment shall be kept in a dry, dust free, temperature controlled area, free from temperature and humidity fluctuations, and in accordance with the equipment manufacturers recommendations. As a minimum, temperature shall be kept above 55 degrees F and no condensation shall occur.

PART 2 - EQUIPMENT

2.01 GENERAL REQUIREMENTS

A. The Contractor shall furnish and install control panels and enclosures to house all instrument, control and electronic equipment, wiring, terminals and accessories. Control panels and enclosures shall be provided as stated herein. Control panels and enclosures shall be assembled, wired, and tested in the Controls Suppliers own or other Engineer/City approved facility of his choosing. All components and all necessary accessories such as power supplies, power conditioning equipment, mounting hardware, input and output terminal blocks, plug strips, relays, lighting, circuit breakers, fuses, etc., which may be required to complete the system shall be provided. Internal layout and internal point to point wiring for typical panels shall be identical.

B. Unless otherwise indicated, panels, enclosures and all exposed panel mounted devices, shall have a minimum of a NEMA 12 rating. Enclosures shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or approved equal to stiffen panels and

doors and facilitate mounting of internal components or equipment. Enclosures shall be 16 USS gauge for units with all dimensions 24 inches or less, 14 USS gauge for units with all dimension greater than 24 inches and less than 48 inches. Enclosures with any dimension of 48 inches or more shall be 12 USS gauge. All floor mounted units shall be 12 USS gauge and shall be provided with jackscrews for leveling. For large and floor standing panels, each shipping section shall be provided with four removable lifting lugs.

C. Doors shall be formed, with welded continuous hinged swing type with the hinge running vertically. Door swing shall be a minimum of 165 degrees. Door closure hardware on NEMA 12 units shall be a three point closure system with single external lockable handle. Multiple clamp type closure is acceptable for small enclosures containing only terminals or non maintenance items. NEMA 4 and 4X units shall have multiple clamp type closures on three sides of the door with padlock accessories and locks. Sufficient doors and access panels shall be provided to facilitate maintenance and testing of the supplier's equipment. All doors shall be fitted with common keyed locks. The door edges and panel opening shall be rolled to prevent the entrance of water and debris when panels are opened.

D. The use of prefabricated, standard "Hoffman" type industrial enclosures is acceptable. The enclosures shall be purchased factory finished as required herein.

E. Provide additional stiffeners or separate mounting panels for OIT units mounted in panels.

F. Steel members shall be provided in the back of the panel for rigidity and support of wiring, accessories, etc. Stiffeners shall be welded to the back face of the panel where required. Stiffeners shall not interfere with instrument installations and weld marks/discoloring shall not be visible. Sufficient stiffeners and/or supports shall be provided so that the panel face does not distort due to the weight of the instruments or equipment.

G. All equipment and devices shall be identified with engraved nameplates both inside and out. The equipment shall be mounted such that service can occur without removal of other equipment. Face mounted equipment shall be flush or semi-flush mounted and gasketed, with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating.

H. The Contract Drawings show approximate dimensions of control panels and preferred front layout. The Contractor shall be responsible for detailed design of all control panels and enclosures. All panels and enclosures shall have a minimum of 6 inches of clear perimeter gutter space from internal equipment (including terminal strips and wireway) to the enclosure wall. Enclosures with a dimension greater than 36 inches shall have a minimum of 12 inches clear gutter space. Panel enclosures shall not be crowded. Ample space shall be provided between components to allow for heat dissipation and servicing. The internal components shall be arranged such that they can be serviced without removing other components.

I. All control panels shall have a single power supply entry point and a power disconnect switch. Control devices shall be mounted in functional groups in accordance with good panel design practice so as to present a neat and functional appearance and so as to be

readily identifiable and accessible for adjustment and service. The panel arrangement shall be approved by the Engineer.

J. All panels and enclosures shall have sub plates and sub panels for mounting equipment. These shall be USS gauge #10 minimum and painted gloss white. A bonding jumper to the enclosure, of #10 AWG copper wire or braid shall be provided.

K. Cut outs shall be made, without distorting the face of the panel, to the dimensions and tolerances specified on the instrument manufacturer's certified drawings. Cutouts shall be saw cut or punched smooth and straight, or round as required, parallel to the panel sides and ground smooth and free from burrs. Flame cutting will not be accepted. Both the front and back surfaces of the panel face near the cut outs shall be level to permit proper instrument installation.

L. Panels shall be furnished with red laminated plastic warning signs in each section. The sign shall be inscribed "WARNING This Device Is Connected To Multiple Sources Of Power". Letters shall be 1/2 inch high, white.

M. Floor mounted panels shall be free standing, requiring no external bracing or support. Angle Iron framing shall be provided at the bottom part of each panel. The framing shall be box construction, with all corners fully welded, and shall be reinforced with additional members as required to prevent buckling or distortion of the frame or the panel face due to normal handling during transportation and final assembly. The bottom 12 inches of floor mounted panels shall have no equipment or terminals located there.

N. The rack framework shall be welded steel construction 1 5/8 x 5/8 inch using Powerstrut, Unistrut, or approved equal and/or angle iron to provide a rigid assembly. Racks shall be of open, box like framework with all frame supports welded and ground smooth. Steel straps shall be used for locating terminal blocks. The terminal blocks shall be factory assembled on a miniature mounting channel and the channel bolted to the steel strap.

O. The joints at the bottom of the panel shall be even and flat to within 1/16 inch. Care shall be taken that the weight of each section is carried by the framework, and not by the bottom edge of the panel face.

P. Panels, which are mounted on concrete slab shall be furnished with base bolt holes at the channel base for use in anchoring the panel to the slab. Removable lifting lugs shall be provided at the top of each panel. All mounting hardware and anchors shall be of 316 stainless steel.

Q. Floor standing panels shall have solid bottoms. Panels in control rooms shall have all wireways brought directly into the panel bottom.

R. All panels and enclosures shall be provided with a steel pocket for keeping drawings. One extra set of the as built drawings shall be provided and kept in the panel.

2.02 ELECTRICAL REQUIREMENTS

A. All control panels and enclosures shall be powered by 120 vac unless otherwise specified. UPS protection shall be provided as indicated and will be supplied under this Contract. Panels and enclosures containing operator interface terminals shall have UPS protection for the OIT. The UPS shall be provided in accordance with Division 16.

B. The wiring terminals shall be rail mount, screw type lift plate or suitable for solderless horseshoe connectors and rated at least 20 amps at 600 volts. The screws for solderless terminals shall be # 8 minimum. They shall be marked with a permanent, continuous marking strip from end to end with the numbers appearing on the approved shop drawings. One side of each terminal strip shall be reserved exclusively for field wiring. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal. Subject to the approval of the Engineer/City, a vendor's pre engineered and prefabricated wiring termination system will be acceptable. Terminals for field wires shall be provided in an easily accessible area of the panel.

C. Terminal blocks for current transformer circuits shall be the shorting type. Shorting terminal blocks shall be provided for all C.T. circuits when entering or leaving the panel.

D. Wiring shall comply with accepted standard instrumentation and electrical practices. For each pair of parallel terminal blocks, the field wiring shall be between the blocks. Lift plate or box type terminals shall be used for connecting wires to terminal blocks. Solderless horseshoe connectors with insulating sleeves and # 8 bolt hole shall also be acceptable. The terminals for field wiring shall be properly sized UL approved to accept field wires of #12 gauge. Fused terminal blocks of the same style shall be used for all output connections to field devices.

E. All wiring shall be enclosed in vented plastic wireway with covers. Wireways shall not be filled to more than 40% of capacity. Where wireway is not possible, conductors shall be run open and shall be bundled and bound at regular intervals, not exceeding 6 inches with nylon cable ties. The bundles shall be secured at intervals not to exceed 12 inches. Care shall be taken to separate electronic signal, discrete signal, and power wiring. Where wiring crosses on to a hinged panel, the wiring shall be bundled and run vertically along the hinge as long as possible to better distribute the twisting forces. The bundle shall be secured at both ends to the panels.

F. Interior panel wiring and field wiring shall be color coded and tagged at all terminations and devices with machine printed plastic sleeves. The wire number shall be as indicated on the approved shop drawings.

G. All incoming and outgoing wiring shall terminate on panel terminal blocks unless approved otherwise in writing by the Engineer. The System Supplier shall furnish all wiring between panel mounted instruments and the terminal blocks. Terminal blocks shall be rated at least 600 volts, 20A, Square D Type G, or approved equal.

H. At shipping joints, interpanel wiring shall be completely installed, terminated with terminals, identified, factory tested and then coiled back for shipping.

I. All wiring to devices mounted on enclosure doors shall be extra flexible and enough slack must be provided to prevent any tension when doors are at maximum opening. Wiring bundles run from panels to doors, shall be run lengthwise along the hinge to spread the opening torque along the greatest length of cable. Permanent cable anchors shall be provided at both ends of the cable to eliminate any torque being applied to wiring terminals.

J. All wire mounts shall be either Epoxy glued or screwed to the equipment mounting plate. Screws shall not penetrate the enclosure. Stick on or self sticking wire mounts will not be acceptable.

K. For incoming wiring provide enclosed wiring troughs in the panel reserved for incoming field wires and wireways from the troughs direct to instrument terminals. Provide these troughs at bottom of panel if incoming wiring is from below.

L. Terminal block layout shall be such as to provide ample access to wiring during installation, checkout, and maintenance. Minimum spacing between adjacent terminal blocks and/or panel edge shall be 6 inches. A minimum of 6 inches space shall be provided at the top and bottom of panels and enclosures.

M. Duplicate terminals shall be provided on the panel for common field wires (such as annunciator common, AC power leads, neutrals, etc.) to limit the maximum number of wires on a terminal to two. Spare terminals equal to not less than 25% of the required points shall be furnished. Jumpers if required shall be connected to the panel manufacturer's side of the terminal blocks.

N. All incompatible circuits (such as low level signals) shall be separated from power circuits and/or each other with separate slotted wireway and junction boxes.

O. Wire for 120 Volt, 60 Hz control circuits shall be minimum No. 14 AWG stranded copper, NEC type MTW/THHN with 600 Volt insulation, and minimum 90 degree C rating. AC power wiring shall be 12AWG minimum. Internal wiring for panels controlling 4160 volt equipment, main pumps, blowers, switchgear. etc. shall be wired using 14 AWG tinned copper SIS wire. Wiring for current transformer circuits shall be 10 AWG tinned copper SIS and shall be yellow. Wiring for potential transformer circuits shall be 12 AWG SIS.

P. Wire for 24volt DC Signals shall be minimum No. 16 AWG stranded tinned copper, shielded twisted pairs. Where terminated or connected, the end of the jacket and shield shall be sealed with heat shrink tubing.

Q. All AC and DC control and power wiring as well as all signal wiring, shall be tagged on both ends. Where contract documents have not specified wire numbers, the wire numbering scheme from the approved shop drawings shall be used. Terminals on panel terminal blocks shall be identified with a terminal block number and terminals shall be in sequential order.

R. Instrument transmission and control wires and associated panel terminal shall be identified with the instrument tag number, function, and polarity.

S. Indicating lights color shall be as follows:

COLOR	FUNCTION
RED	RUNNING, BREAKER CLOSED
RED (FLASHING)	ALARM
GREEN	MOTOR OFF, BREAK OPEN,

	VALVE CLOSED
WHITE	CONTROL POWER ON
BLUE	VALVE OPEN

T. Where indicated or required by codes, all panels and panel mounted equipment shall be explosion proof .

2.03 POWER DISTRIBUTION

A. Electrical power shall be distributed throughout the panel and field instrumentation requiring 120 VAC, 60 Hz, by means of a power distribution panel or individual fuses. There shall be a common power disconnect switch.

B. The number of circuit breakers or fuses shall depend upon the process functional requirements. The circuit breakers shall be arranged in neat functional groups so that an overload or short circuit inside the panel shall disable only a part of the process. As a minimum, circuits pertaining to one piece of equipment shall be fused or protected separately to allow servicing of that piece of equipment without affecting others.

C. Surge protectors and power conditioners shall be provided for all electronic equipment located inside the panel. To provide protected power at a level that is safe for all connected equipment.

D. An additional 120 vac duplex receptacle shall be provided in any panel or enclosure which contains equipment that requires programming or calibration. This shall be for powering laptop computers and test equipment only.

2.04 LIGHTING

A. Panels with any dimension 48 inch or greater or a depth in excess of 12 inch shall have internal lighting. Fluorescent lighting shall be used unless it will have a detrimental effect on enclosed equipment. A SPST toggle switch or door actuated switch and lighting fixtures with lamps shall be provided as required to illuminate the entire panel interior.

2.05 GROUNDING

A. Each panel mounted device shall be bonded or otherwise grounded to the subpanel on which it is mounted by means of machine threaded screws with locknuts, lock washers or other pressure mounting methods.

B. Each panel shall be provided with at least two copper ground busses, one for AC instrument power (normally 115 VAC 60 Hz) grounds and one for DC signal grounds. The DC ground bus must be electrically isolated from the panel board.

C. The DC ground bus shall be connected to a remote grounding rod by means of an independently run #2 AWG insulated copper ground wire.

D. Ground busses shall be minimum 1/4 inch x 1 inch x 8 inch with two (#2/0) AWG lugs for connection to plant grounding system. These grounding busses shall be predrilled for connection of instrument, panelboard, or cable shield connection.

E. When panel or field wiring for electronic instruments is specified shielded, a shield terminal shall be provided for each control loop at the terminal strip connection to and from field instruments. Shields shall be connected through the field terminal strip and continued to the equipment connection. Each shield shall be grounded at one point only, and this ground connected to the DC ground bus in the panels or as required by the equipment manufacturer.

F. Subpanels for mounting of internal equipment, enclosure doors and all internal metal objects shall be grounded by means of a #10 AWG bonding jumper.

2.06 CONTROL LOGIC

A. Control logic shall be performed using relays and/or PLCs as indicated and required. When not so indicated, logic shall be performed using hardwired relay logic and shall be monitored by the PLC.

B. The control logic for fan/damper control, stop/start operation of heating and ventilating units, dehumidification units, Supply and Exhaust fans shall be implemented using relay logic with PLC monitoring as indicated and PLC generated start/stop commands when in workstation (remote) mode.

2.07 ENCLOSURE MATERIALS, TEMPERATURE CONTROL AND AREA CLASSIFICATION

A. Enclosures for outdoor service shall be 316 SS NEMA 4X weatherproof construction with clear polycarbonate framed window in hinged and gasketed door to permit full view of all enclosed instrumentation and/or controls without opening. All doors shall be fitted with common keyed locks. Panels shall be suitable for wall or pipe mounting. Panels shall be insulated and equipped with thermostatically controlled internal space heaters for severe winter service. Heaters shall maintain 50 degree F interior temperature at a 0 degree F ambient temperature. Fiber glass enclosures will not be accepted.

B. Enclosures located inside electrical equipment rooms, administrative areas or air conditioned control rooms in non contaminated areas as well as floor standing panels containing an OIT, shall have a minimum of a NEMA 12 rating and shall be corrosion resistant. Corrosion resistant enclosures shall be made of 316 SS, or steel, coated with a powdered resin which is heat-cured 100% solid thermosetting epoxy.

C. Enclosures used in all other areas, except hazardous locations, shall be rated NEMA 4X and shall be fabricated out of 316L stainless steel unless otherwise indicated. All the devices and hardware on the front of NEMA 4X rated panels will be specifically NEMA 4X rated. Splash-proof equipment and hardware shall not be acceptable for mounting on NEMA 4X panels. All enclosures shall include sealed gasketed doors to protect internal equipment from outside air.

D. All enclosures containing heat generating equipment shall include integrally mounted fans to circulate the air within the enclosure and remove heat from the modules.

Enclosures and doors shall be designed to dissipate heat through their exterior surfaces into the plant environment. Air shall not be exchanged between the enclosure's interior and the outside environment. Alternatively, cooling air can be drawn from non-contaminated area.

E. Enclosures and panels located in areas where chlorine liquids or gasses are handled stored or transported, shall be fabricated out of a material suitable for use in such an atmosphere. Material selection shall be approved by the Engineer.

2.08 CONTROL, SELECTOR AND PUSH BUTTON SWITCHES

A. Switches and push-button type operators shall be rated for the enclosure in which they are mounted. As a minimum, all devices shall be NEMA 12 and 13, oil and water tight. Switches and operators mounted in NEMA 4X panels shall have a NEMA 4X rating. All operators used on the project shall be from one manufacturer and shall be the same line.

B. Devices shall be of the 30.5 mm type rated for extra heavy duty service.

C. Selector switches shall have gloved hand operating handles.

D. Push buttons shall be of the guarded type except those being used for stop control.

E. Emergency stop push buttons shall be Push - Pull type with maintained contacts.

F. Control and selector switches for control of 5 KV equipment and circuit breakers shall be switchgear duty control switches General Electric SB1, SBM or approved equal. Circuit Breaker trip control switches shall have 2 parallel contacts. Close switches shall have 2 series contacts. Normal after close and normal after trip contacts shall be provided.

G. Control switches, selector switches, push buttons, etc. for use in explosion proof (NEMA 7) panels and/or equipment located in hazardous areas shall be rated explosion proof for use in Class 1 Division 1 atmospheres.

2.09 INDICATING LIGHTS

A. Indicating lights shall be 120 volt transformer type, with replaceable high intensity L.E.D. type lamp, unless otherwise noted.

B. Indicating lights shall be rated for the enclosure in which they are mounted. As a minimum, all devices shall be NEMA 12 and 13, oil and water tight. Indicating lights mounted in NEMA 4X panels shall have a NEMA 4X rating. All indicating lights used on the project shall be from the same manufacturer as the operators specified above and shall be the same line.

C. Devices shall be of the 30.5 mm type rated for extra heavy duty service.

D. Indicating lights shall be push to test type. The push to test feature shall not interact with any other circuitry.

E. Indicating lights for use in explosion proof (NEMA 7) panels and/or equipment located in hazardous areas shall be rated explosion proof for use in Class 1 Division 1 atmospheres and shall be push to test type.

2.10 RELAYS

A. General purpose control relays shall be the socket mounted type for DIN rail mounting. Relays shall be tube socket or quick connect square base type. Miniature relays are not acceptable. Each relay shall have a minimum of two or three single pole double throw contacts each rated 5 or 10 amps as required. The relays shall have a push to test feature and a coil indicating light. Potter & Brumfield KRP, KUP, or approved equal

B. Relays used for control of motors shall have a horsepower rating above that of the connected motor at the appropriate voltage. Motor overload protection shall be provided.

C. Relays used for emergency shutdown and safety circuits, those common to several pieces of equipment and all relays associated with control or monitoring of 5 KV equipment shall be 4 pole (min.) 600 volt machine tool type. Contacts shall be convertible type with a 10 amp minimum ratings. These units shall be Allen-Bradley class 700 P, or approved equal.

D. Relays used for control of 5 KV or higher circuit breakers shall be utility grade switchgear control relays having the proper AC and DC ratings. These units shall be General Electric type HGA, HFA, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All panels and enclosures shall be mounted straight, level and parallel to building surfaces.

B. Wall mounted panels and enclosures shall be securely mounted to walls or columns as indicated. They shall be spaced a minimum of 3/4 inch from the structure using strut or plates.

C. Stand mounted units shall be supported using steel channel securely mounted to the floor with a minimum of four 1/2 inch stainless steel bolts. Stands shall be secure and level, shall easily support the mounted equipment and shall hold the equipment rigidly.

D. All free standing control panels shall be installed on a 6 inch wide and 4 inch high reinforced concrete curb with chamfered corners. The curb shall be 1 inch larger than the panel on all sides.

E. When panels or enclosures are installed on raised computer type floors, additional supports and bracing shall be provided under the floor as required to prevent the floor from being overloaded. Large and/or heavy panels having any dimension larger than 72 inches or weighing 300 lbs or more or where the weight of the completed panel exceeds 80% of the specified load bearing capacity of the flooring, shall be supported from the structural sub floor independently of the raised floor. Provide a welded steel support framework the size of the unit footprint capable of rigidly supporting the weight of the entire panel with a 50% safety factor. The floor system shall be installed flush and level with this frame. Load and bracing calculations shall be submitted for review.

F. It shall be the responsibility of this Contractor to coordinate floor installation requirements with the appropriate Contractor. In areas where floor modifications are

required, and the floor has already been installed, the Contractor shall retain the services of an approved flooring subcontractor to make the appropriate modifications at no additional cost to the City.

END OF SECTION

SECTION 26 93 00
FUNCTION CONTROL DESCRIPTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section describes the general function of each primary control loop to be modified or included. The Control System Integrator (CSI) shall provide additional functions as needed to adhere to good control and engineering practices. These additional functions shall be outlined and explained as part of the submittal process.

B. Manufacturer/Vendor supplied controls as specified in other sections shall be the CSI's responsibility to integrate into the overall control system.

C. The CONTRACTOR will be responsible for securing a Control System Integrator for completing all control, SCADA, and implementation work described herein and as reflected in the Drawings to provide a fully operational booster pumping station.

D. Refer to Control System Integrator requirements.

PART 2 - PRODUCTS

2.01 HUMAN MACHINE INTERFACE SOFTWARE

A. Basis of Design

1. The basis of design is to provide a new SCADA System.
2. New PLCs will be integrated into the existing SCADA communications network.
3. New SCADA system HMI hardware (server(s) and workstations) shall be installed.

B. RTU HMI/OIT Hardware

1. The basis of design RTU HMI's/OIT's are shown in the contract drawings.
2. HMI hardware shall have the following minimum hardware requirements

    a. Form Factor:

        1) Panel Mount

    b. Environmental:

        1) NEMA 4X/IP65

c. Touchscreen:

1) Resistive or Capacitive

d. Electrical:

1) 24VDC

e. Communications:

1) Minimum (1) Ethernet port

C. HMI Software General Requirements

1. HMIs shall serve as an interface to the parent PLC. The HMI shall not contain any logic or control functions necessary for operation of the control system in the event that the HMI fails. The system intent is that the PLC serves as the central control of any control system with the ability to be interfaced through another HMI or SCADA system.
2. The HMI shall be configured to perform all interface functions and displays in accordance with the contract drawings and Specifications.
3. The Control System Integrator shall develop all HMI application code. The Integrator shall review the contract drawings and Functional Design for the system logic and interfaces required and provide a functionally complete system for approval.
4. The Control System Integrator shall include versioning of the HMI application software by displaying the current version on the main overview or title screen as appropriate. The software versioning shall display major and minor versioning information (e.g., 1.01 where 1 is the major version and .01 is the minor version). All versions shall be compatible with the provided system.
5. The Control System Integrator shall ensure that testing of all HMI code is included in the FAT (Factory Acceptance Tests), Commissioning, and startup checklists, and in the SAT (Site Acceptance Tests).

PART 3 - EXECUTION

3.01 SYSTEM DESCRIPTION

A. This project includes work at the following sites:

1. Rockville Water Treatment Plant.

B. In general, all process functional control and annunciation available locally at the facility HMI shall also be available remotely through the SCADA system.

C. Overall requirements of the operating and control system are as described in the functional descriptions in these specifications as well as the instrumentation and control schematics included in the project drawings.

D. The general functionality of the motor driven equipment includes Local-Off-Remote selector switches. In the “Remote” position, the motors shall be controlled from the Wastewater

treatment plant control system, using a remote I/O device installed in the local control panel mounted in the field and based on the descriptions provided in these specifications. In the "Local" position, the motors shall be called to run manually from the device or indicated panel.

E. Return from power loss:

1. Following the restoration of power from any power loss event, the control system shall reset all applicable devices and automatically resume operation of the systems described.

3.02 ALARM CONDITIONS

A. All alarm conditions for the proposed equipment shall:

1. be displayed on the HMI (Human Machine Interface) located on the system control panel.
2. be recorded in the HMI alarm database
3. trigger the alarm contacts associated with the SCADA system

3.03 PASSWORD PROTECTION

A. Programming functions shall be password protected within the HMI to prevent accidental manipulation of pump PID control loop settings. Coordinate with CITY and ENGINEER for additional items to be password protected.

B. System shall have login functions for Admin (Full read/write control), Engineer (Full read/write control), and Operator (Limited visibility and setpoint adjustment)

3.04 DATA ARCHIVAL AND TRENDING

A. The HMI shall be configured to trend all points connected to the station control system within the HMIs available memory. Provisions for periodic automatic archiving of data to City's server via SCADA, before loss from local memory, shall be incorporated. Archiving frequency shall be determined by the City.

3.05 HUMAN MACHINE INTERFACE SCREENS

A. The following screens shall be available on the HMI system in the existing control system. All screens shall include an alarm banner and dedicated alarm screen. All motors connected to the Control System shall include a motor nameplate screen which will function as described for each motor type in Section 3.06.

1. Bulk Hypochlorite storage system Overview, Page one:

a. All Instantaneous Tank Levels, Tank High level, and Tank High High level.
b. Transfer Pump Status including Pump in Remote, Pump in Local, Pump Running, Pump Fault

2. Hypochlorite Metering:

    a. Metering pump status, as all signals as shown on the P&IDs
    b. Valve Status: all signals as shown on the P&IDs.

3.06 DEVICE FUNCTIONAL CONTROL DESCRIPTIONS

A. LEVEL TRANSMITTERS

1. The Bulk Storage Tanks and Day Tank shall be provided with level transmitters and dual output indicator transmitters that will report the tank levels to the local PLC, Filling Control Panel and through SCADA to the plant control system.
2. The operator shall be able to set the following setpoints: Low Level, Pumps Off Level, and High Level.
3. The HMI shall display the following:

    a. Instantaneous level of the Tank.
    b. High Level Alarm
    c. Low Level Alarm

4. The CONTRACTOR shall set the elevations in the field at the direction of the CITY and ENGINEER. The Levels Shown below are initial levels to be updated during Site Acceptance Testing. CONTRACTOR shall record setpoint elevations and ranges in the following table and in the construction as-built documents.

TABLE 3.06.A - LEVEL TRANSMITTERS

Transmitter ID	Description	Setpoint/ Range
LIT-A, LIT-B	Bulk Tank High Level Alarm	TBC
LIT-A, LIT-B	Transfer Pumps Off Level	TBC
LIT-A, LIT-B	Bult Tank Low Level Alarm	TBC
LIT-C	Day Tank High Level Alarm (Stop Transfer Pumps)	TBC
LIT-C	Metering Pumps Off Level	TBC
LIT-C	Day Tank Low Level Alarm (Start Transfer Pumps)	TBC

B. FLOAT BACKUPS

1. The tanks shall be equipped with floats to serve as backup level control in the event of a failure of the Level Transmitter.
2. The HMI shall display the following:

    a. High-High Level Alarm for Each Tank
    b. High-Level Alarm for the day tank

3. The CONTRACTOR shall set the float elevations in the field at the direction of the CITY. Record float elevations in the following table and in the construction as-built documents.

TABLE 3.06.B - FLOAT BACKUPS		
Float ID	**Description**	**Elevation**
LSHH-A	Bulk Tank High-High Level Float	TBC
LSHH-B	Bulk Tank High-High Level Float	TBC
LSHH-C	Day Tank High-High Level Float	TBC
LSH-C	Day Tank High Level Float	TBC

C. Transfer Pumps

1. The Hypochlorite system is equipped with two transfer pumps for moving Hypochlorite from bulk storage tanks to a day tank.
2. The control system shall monitor and control the status of the transfer pumps.
3. The control system shall monitor the status of the pump faults, and availability of pumps.
4. For further details on the field devices, refer to the project drawings.
5. When in auto mode, the pumps shall operate in accordance with the narrative in Article 3.07.
6. For each pump, the HMI shall display the following:

    a. Pump in Remote Status,
    b. Pump in Local Status,
    c. Pump Running,
    d. Pump Fault Status,

7. Interlocks

    a. The control system shall interlock the pumps and prevent running under the following conditions with a password protected override for each:

        1) Bulk Tank Low-Low Level Alarm
        2) High Motor Thermal per pump

D. Metering Pumps

1. The Hypochlorite system will consist of six active and one standby hypochlorite metering pump.
2. The control system shall monitor and control the status of the metering pumps.
3. The control system shall monitor the status of the pump faults, pump speed, and availability of pumps.
4. For further details on the field devices, refer to the project drawings.
5. When in auto mode, the pumps shall operate in accordance with the narrative in Article 3.07.
6. For each pump, the HMI shall display the following:

    a. Pump in Remote Status,
    b. Pump in Local Status,
    c. Pump Running,
    d. Pump Speed Command

e. Pump Speed Feedback
f. Pump Fault Status.

E. Metering pump isolation valves

1. The Hypochlorite metering system will consist of motor actuated isolation valves, one for each metering pump.
2. The control system shall monitor and control the status of the valves.
3. The control system shall monitor the status of the valve faults, valve position, and availability of valves.
4. For further details on the field devices, refer to the project drawings.
5. When in the auto mode, the valves shall operate in accordance with the narrative in Article 3.07.
6. For each valve, the HMI shall display the following:

a. Valve in Remote Status,
b. Valve in Local Status,
c. Valve open status,
d. Valve closed status
e. Valve Fault Status.

3.07 WATER TREATMENT PLANT SYSTEMS FUNCTIONAL CONTROL DESCRIPTIONS

A. BULK HYPOCHLORITE TRANSFER OPERATION

1. The control system shall monitor the level of the day tank level transmitters.
2. As the level falls to the day tank low level, the control system shall start a transfer pump.
3. The pump shall run until the day tank high level, or transfer pump stop level, is achieved.
4. Establishing Stage and rotation.

a. The transfer pumps shall alternate running each time the day tank is filled.
b. If a transfer pump is not running due to a fault, then the control system shall start the backup pump.

B. METERING PUMP OPERATION.

1. Each primary metering pump has a dedicated feed destination assigned.

a. The backup metering pump may be assigned to any of the primary metering pump destinations. The operator shall be able to select the status and destination of the backup metering pump from the HMI. When so assigned, the control system shall automatically adjust so that the back pump acts as the assigned primary would have.

2. The control system shall flow pace each metering pump based on control signals from existing variables within the plant. The signals are as shown below

TABLE 3.05.B - FLOAT BACKUPS		
Metering Pump ID	**Assigned Destination**	**Basis for Flow Pacing**
SHP-A	Refer to P&ID	TBC
SHP-B	Refer to P&ID	TBC
SHP-C	Refer to P&ID	TBC
SHP-D	Refer to P&ID	TBC
SHP-E	Refer to P&ID	TBC
SHP-F	Refer to P&ID	TBC
SHP-G	Back up, operator assigned to any of the above.	Determined by Back up selection.

3. Based on the flow pacing signal, the control system shall call the metering pump to run at the required speed using a PID loop.

END OF SECTION

SECTION 26 95 00
FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Requirements for the installation, and general integration of primary measurement devices, sensors and instrumentation into the SCADA systems.
2. Requirements for the purchase, tagging, scaling and configuration of primary measurement devices and process instrumentation

B. Related Sections: Division 26.

1.03 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on sea-level conditions.

B. Operating Temperature: 0 degrees F to 100 degrees F.

C. Environment: Reclaimed Water.

1.04 SUBMITTALS

A. Submit shop drawings.

B. Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:

1. Sensor housing, NEMA rating.
2. Power requirements.
3. Sensitivity ranges.
4. Mounting requirements.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connections.

D. Coordination Drawings, including plumbing/connection plans and sections drawn accurately to scale. Submit with Shop Drawings. Show layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

E. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

1.05 QUALITY ASSURANCE

A. Electrical Component Standard: provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Each instrument shall provide direct programming capability through the PLC

C. Each instrument shall be supported with a device profile permitting direct integration in the PLC

D. The ENGINEER or the ENGINEERS appointed Representative shall witness all instrument verifications in the field.

E. The Manufacturer field service representative shall verify installation of all installed sensors, cables and transmitters.

F. Manufacturer representative shall notify the ENGINEER in writing of any problems/discrepancies and proposed solutions within 24 hours of discovery. (The ENGINEER shall be the sole party responsible for determining the corrective measures).

G. Manufacturer representative shall generate a configuration report for each sensor and transmitter installation following commissioning and it shall be provided to the ENGINEER within 48 hours.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver units as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Lift and support units with the manufacturer’s designated lifting and covering.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements. Verify clearances for installation.

1.08 COORDINATION AND SCHEDULING

A. Coordinate with the ENGINEER for the mounting locations of each instrument prior to installation.

1.09 SPARE PARTS

A. Furnish any spare parts that are expected to be replaced within a 1-year period in sufficient quantity to keep monitoring equipment operating for a minimum period of one year.

1.10 WARRANTY

A. All equipment supplied under this section shall be warranted for a period of one (1) year by the MANUFACTURER from substantial completion.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the CITY.

C. The MANUFACTURER'S warranty period shall run concurrently with the CONTRACTOR'S warranty period. No exception to this provision shall be allowed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide instruments and primary measurement devices as indicated in the design drawings.

B. Refer to design drawings and for instrument locations and installation details.

1. Refer to P&ID's or plans for relevant locations and systems
2. Refer to plan drawings for instrument, RTU, and control panel locations

C. All Instruments with Analog signals (4-20 mA) shall be configured so that in a fault or failure condition, a signal current of less than 3.8 mA will be transmitted.

2.02 FLOW

A. Magnetic Flow Meters

1. The flowmeter shall be Promag 400 Series as manufactured by Endress and Hauser, or approved equal

2. The magnetic flowmeter shall be a pulsed DC volumetric liquid flow rate detector. Coils shall be excited with pulsed DC current. The electronics portion of the magnetic flowmeter shall include both a magnet driver to power the magnet coils and a signal converter. The output signal shall be directly proportional to the liquid flow rate.
3. The metering spool shall have flanged process connections. The metering tube shall be constructed of lined stainless steel (304 SST). The liner shall be manufactured of materials compatible with the service intended. The sensor shall be fitted with measuring and empty pipe electrodes. Flanged meters shall be equipped with grounding electrodes.
4. The flow tube shall be rated IP68 (NEMA 6P).
5. The signal converter shall be microprocessor based and shall perform internal diagnostics of the transmitter condition. The signal converter shall be capable of measuring flow in both the forward and reverse directions. The signal converter shall have a local display and shall indicate flow in engineering units. The signal converter shall output a standard 4 to 20 mA analog signal proportional to flow. The signal converter shall include a local flow totalizer. The signal converter shall utilize 115 VAC supply power. The converter enclosure shall be rated NEMA 4X.
6. The standard accuracy of the metering system shall be 0.25% of reading or better. The meter shall be accurate throughout the anticipated flow range of the meter.
7. The sensor and signal converter shall be supplied from the same manufacturer and shall be supplied with all interconnecting cables and other fixtures as required.
8. The flow sensor shall be supplied with 316 stainless steel grounding rings.
9. The flow transmitters shall be provided with local analog signal surge suppressors for lightning protection.

B. Electronic Propeller Flow Meters

1. The flowmeter shall be Model ML04-D as manufactured by McCrometer.
2. The accuracy of the meter shall be plus or minus 2% of actual flow within the range specified for each meter size.
3. The meter shall have a maximum working temperature of no less than 140 degrees F.
4. The meter shall have a maximum working pressure of no less than 150 PSI.
5. The meter shall include a 4-20 mA output to represent flow and include a remote mounting kit with a minimum of 50 feet of cable.
6. The meter shall include a digital indicator-totalizer with non-volatile EEPROM memory to store totalizer count.
7. The meter shall be manufactured to the highest standards meeting or exceeding AWWA standard C704-02.

2.03 PRESSURE

A. Line Pressure Transmitters

1. Discharge Pressures shall be monitored with an Endress-Hauser Cerabar PMP71 Pressure Transmitter or approved equivalent.
2. The transmitter shall be a 2-wire, high-performance piesoresistive pressure transmitter with digital communications capabilities including HART, Profibus PA or Foundation Fieldbus as required by the plans.
3. Measure millivolt changes in the sensor as pressure varies and produces a linear 4-20mA DC output proportional to the pressure. The unit shall have self-diagnostic capability and a non-volatile memory; Histo-ROM memory module for monitoring of events, configuration changes and periodic recording of temperature/pressure values.
4. Display shall be an integrally mounted 4-line LCD scaled with engineering units.
5. Transmitter shall have a static pressure limit at least 1.5 times the nominal pressure range. Unit shall use DC loop-power supply 10.5 to 45 VDC with self-diagnostic capability and a non-volatile memory.
6. Sensor shall be a piesoresistive, oil-filled element with metal process diaphragm.
7. The unit shall be rated for process temperature of minus 13°F to 257°F and an ambient environment of minus 50 degrees F to 185 degrees F.
8. Reference accuracy shall be +/- .075% of calibrated span including non-linearity hysteresis and non-reproducibility in accordance with IEC 60770. Total performance accuracy including non-linearity hysteresis and non-reproducibility in addition to thermal change of the zero point shall be +/- .2% URL.
9. The transmitter shall be programmable via Hall magnetic switch external pushbuttons without pressure source or handheld device.
   Unit shall have ATEX, FM, CSA or IECEx approvals as required

B. High Pressure Switches

1. High pressure switches shall be Square D Class 9012G or approved equivalent
2. High Pressure switches shall be selected and set to actuate at the shut-off head of the pump which is being protected. Coordinate with the selected pumps and process systems.
3. High Pressure switches shall include an aluminum enclosure with suitable rating for the space in which they are installed:
4. High Pressure switch contacts shall accept a wire range including 12-18 AWG
5. High Pressure switches shall lock on rising pressure with a manual reset only.

2.04 LEVEL

A. Direct Acting Float Switches

1. Direct Acting Float devices are to be mounted vertically and shall be suspended from a weighted stainless-steel cable.
2. The direct acting float switch as manufactured by:

   a. Anchor Scientific,
   b. BW Controls,

c. Siemens,
d. or approved equivalent.

3. Provide 316 stainless steel cable grips with 316 stainless steel hooks to support the level switches.
4. The level switches shall be suspended from a stainless-steel bracket mounted in the clear well. The bracket shall be located above the water level near the access hatch and ladder to facilitate access for maintenance. The mounting bracket shall be accessible from the hatch and ladder.
5. Final locations (Depth or Elevation) of the submersible level switches may change during startup. The Vendor shall install submersible level switches such that the elevation of the transmitter is adjustable.

B. Free Space Radar Level Transmitters

1. Subject to compliance requirements, provide unites by one of the following:
2. Endress+Hauser- Micro-pilot FMR20, or Engineer approved Equivalent.
3. The pulsed time of flight radar transmitter shall operate at 26 GHz using 2-wire technology for level measurement and/or open channel flow measurement.
4. Accuracy shall be and +/- 0.08”
5. Maximum measurement distance shall be 0- 66 ft.
6. The radar shall have CSA C/US General purpose approvals as required.
7. Process Temperature range is -40 to 176 degrees F and pressure range is from -14.5 to 43 psi.
8. The process connection shall be 1” NPT, 1.5” NPT, 2” NTP
9. The radar output signal shall be 4-20 mA dc loop powered.
10. The radar device shall have Bluetooth wireless technology interface and can be operated and configured via this interface using a mobile device application. The range under reference conditions is 33ft. The Bluetooth shall have both encrypted communication and password encryption for security purposes. The Bluetooth wireless technology interface can be deactivated.
11. The radar signal on alarm shall be 22.5 mA
12. The radar unit shall be rated for and IP68, NEMA 6P.
13. The radar sensor body material shall be made of PVDF
14. The radar sensor must have hermetically sealed wiring and fully potted electronics eliminating water ingress.

C. Tank Level Transmitters

1. Tank Level shall be monitored with an Endress-Hauser Cerabar PMP71 Pressure Transmitter, adapted for liquid level measurement or approved equivalent
2. The transmitter shall be a 2-wire, high-performance piezoresistive pressure transmitter with digital communications capabilities including HART, Profibus PA or Foundation Fieldbus as required by the plans.
3. Measure millivolt changes in the sensor as pressure varies and produces a linear 4-20mA DC output proportional to the pressure. The unit shall have self-diagnostic capability and a non-volatile memory; Histo-ROM memory module for monitoring

of events, configuration changes and periodic recording of temperature/pressure values.

4. Display shall be an integrally mounted 4-line LCD scaled with engineering units.
5. Transmitter shall have a static pressure limit at least 1.5 times the nominal pressure range. Unit shall use DC loop-power supply 10.5 to 45 VDC with self-diagnostic capability and a non-volatile memory.
6. Sensor shall be a piezoresistive, oil-filled element with metal process diaphragm.
7. The unit shall be rated for process temperature of minus 13°F to 257°F and an ambient environment of minus 50 degrees F to 185 degrees F.
8. Reference accuracy shall be +/- .075% of calibrated span including non-linearity hysteresis and non-reproducibility in accordance with IEC 60770. Total performance accuracy including non-linearity hysteresis and non-reproducibility in addition to thermal change of the zero point shall be +/- .2% URL.
9. The transmitter shall be programmable via Hall magnetic switch external pushbuttons without pressure source or handheld device.

D. Tank Level Switches

1. Level switches for the tank shall be Square D Class 9012G pressure switches adapted for tank level measurement or approved equivalent
2. Pressure switches shall be selected and set to actuate at the water elevation in the tank corresponding to the required high or low-level elevations. Coordinate with the plans for determining the required pressures.
3. Pressure switches shall include an aluminum enclosure with suitable rating for the space in which they are installed:

    a. Outdoor Switches: NEMA 4X
    b. Indoor Switches: NEMA 1High

4. Pressure switch contacts shall accept a wire range including 12-18 AWG

2.05 WATER ANALYSIS

N/A

2.06 TRAINING

A. Train CITY's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.

B. Demonstrate operation of products specified in this Section. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each product.

2.07 INSTALLATION

A. Install according to manufacturer's written instructions.

B. Install units with clearances for service and maintenance.

C. Each pump shall be provided with a suction and refer to the mechanical details for pressure gauge installation requirements discharge pressure gauge.

D. All pressure transmitters shall be installed using a stainless-steel isolation valve and stainless-steel pipe nipple. Provide a stainless-steel diaphragm seal for each pressure transmitters.

E. All transmitters shall be provided with sun/rain hoods.

F. Field instruments shall be factory calibrated and delivered to project site with certificates. Contractor shall coordinate process ranges in the field and document as-built I/O list with calibrated process ranges for turnover to the City.

G. Equipment shall be installed as shown on the Drawings and in accordance with the approved shop drawings and equipment manufacturer's installation instructions.

H. Wiring shall be installed as shown on the schematics or loop diagrams and in accordance with Division 26 – Electrical and design drawings, to obtain a completely functional control system.

2.07 CONNECTIONS

A. Electrical: Conform to applicable requirements in Division 16 Sections.

B. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

2.08 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation and electrical connections, and to report results in writing.

B. CONTRACTOR shall install all equipment and related accessories before having the manufacturer's field service. If additional trips are required due to incorrect installation, CONTRACTOR shall pay for the costs for the field services.

2.09 START-UP SERVICE

A. The systems integrator shall provide field services for as many days as necessary to test, calibrate, troubleshoot, and place into satisfactory service the entire instrumentation system.

B. Once the system is operational, the systems integrator shall provide onsite instruction and training services to the CITY's personnel as detailed in these specifications.

C. The services of a qualified representative from each manufacturer shall be pro-vided to inspect the completed equipment installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment furnished. Every instrument is to be calibrated to its manufacturer's stated accuracy.

D. All necessary tools, test instruments or other devices required to perform a three-point calibration for each instrument are to be provided by the manufacturer's representative.

E. Field calibration shall be supervised by the project coordinator and witnessed by the Design Builder or his representative. A minimum of two days advanced notice of such calibration shall be given to the Design Builder.

F. The supervision of equipment start-up and the instruction of the District personnel in operation of the instrumentation and controls shall be performed by factory trained representatives of the equipment manufacturers.

G. After the system is operating satisfactorily, the performance shall be demonstrated to the satisfaction of the District, who will be the judge of its acceptability.

H. Cost of providing manufacturers service representative for start-up and for training plant personnel shall be borne by the Vendor and is included in the Contract Price. No time or trip limitations shall be placed on these services.

2.10 TESTING

A. Perform testing, commissioning and startup as defined in the associated scope of work section.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 26 99 10
FACTORY ACCEPTANCE TESTING (FAT)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. A FAT shall be performed after the system is manufactured and configured prior to shipment to the site. The CSI shall provide labor, tools, material, and equipment for performing the factory acceptance tests on the system.

B. The CONTRACTOR shall be responsible for coordinating the FAT of the proposed control system with all involved parties including OWNER, ENGINEER, control panel supplier, control system integrator, and other equipment vendors as applicable.

C. The control system integrator (CSI) shall provide detailed FAT protocol documents prior to the commencement of FAT. FAT protocol documents shall include test plan, schedule, and document to record punch list items.

D. Protocol documents for testing equipment and functionality shall include but not be limited to:

1. All pump system control equipment
2. PLC control function for all system control equipment
3. PLC interface with other systems
4. Communication equipment configuration and operation.
5. OIT graphic displays

E. FAT testing shall include all equipment and control panels fabricated in accordance with the project requirements.

1.03 CITED STANDARDS

A. National Fire Protection Association (NFPA):

1. 70, National Electrical Code (NEC)
2. 70E Standard for Electrical Safety in the Workplace 2012

B. The Institute of Electrical and Electronics Engineers (IEEE)

C. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

A. The factory test shall not begin until all related control system and shop drawings have been submitted and approved.

B. All systems, panels, and equipment required for factory acceptance testing are specified in this section.

1.05 QUALITY CONTROL

A. The Integrator shall generate the FAT protocol document.

B. The FAT protocol shall be submitted and approved by the ENGINEER.

C. The Integrator shall certify to the ENGINEER that the entire control system is ready for testing prior to the initiation of the FAT.

D. The factory test shall be declared a failure and a retest shall be required if any of the following were to occur:

1. Failure to meet the requirements of the operational testing of the system as specified in this Section.
2. Failure to meet the acceptance criteria as established in the approved Factory Acceptance Test Procedures.

1.06 SUBMITTALS

A. All submittals shall be provided in accordance with the submittals section of the specifications.

B. The Integrator shall submit information on the factory testing facility and procedures to verify that testing shall fulfill the requirements as specified herein. Submittal shall be made at least 21 calendar days in advance of any scheduled testing and shall include dates of scheduled tests.

C. The control system integrator shall submit Factory Acceptance Test (FAT) Protocols for each item listed in paragraph 1.01C of this document.

D. The approved testing protocols shall be used for recording the test results during the FAT.

E. Factory Acceptance Test protocol documents shall include but not necessarily be limited to the following:

1. Detailed description of system to be tested.
2. Overall scope of testing and acceptance criteria for:

    a. Control Panels

        1) Visual inspection, dimension, access for maintenance
        2) Bill of material verification
        3) Manufacturer's documentation
        4) Recommended spare parts list and spares
        5) Tagging of components
        6) Warning labels, if applicable

    b. Wiring

        1) Visual inspection for cable entry, routing, support
        2) Termination,
        3) Segregation by voltages/type
        4) Review of vendor's reports of tests and checks, if applicable

    c. Software Licenses and Version including firmware
    d. Control Logic – Functional capability, demonstrated to the satisfaction of the Engineer.
    e. Discrete I/O
    f. Analog I/O
    g. Hard-wired Interlocks
    h. PLC logic Interlocks
    i. Alarms
    j. Graphics – Operator interface capability
    k. Tag numbers and database
    l. Communication equipment and configuration
    m. Communication performance
    n. Control system Interface with other systems
    o. Non-standard operating conditions

        1) Loss of power for each component
        2) Communications failure
        3) Removal of each PLC card
        4) PLC failure

3. Factory Acceptance Test Schedule

    a. The CSI and OWNER shall mutually agree upon the test schedule based on project schedule and when the system should be delivered to the site.

b. The ENGINEER and OWNER shall be present for the FAT. A minimum of 2 weeks' notice shall be provided to allow them to attend.
c. The CSI shall include a minimum of five working days in the schedule for FAT,

4. Factory Acceptance Test Punch List

a. Any incomplete work or non-conformances detected during FAT shall be recorded on FAT punch list. Punch list items shall be categorized as follows:

1) Immediate: FAT shall be paused for rectification and FAT shall continue after rectification.
2) On-going: Rectification during FAT and will be completely rectified at the end of FAT. This category is used typically for multiple instances of the same issue which will be rectified during FAT as the issues are encountered.
3) Repeat: FAT should be repeated after rectification and before completion of FAT.
4) Before Ship: Issue to be rectified after FAT but before item is shipped to site. Re-test, if required should be documented and conducted during SAT.
5) At Site: Remaining work to be rectified after shipment. Re-test. If required to be conducted during SAT.
6) Future: Issues that are beyond the scope of the project but something that should be addressed in the future.

5. FAT Punch List at a minimum shall include:

a. Reference to applicable FAT test plan requirement
b. Description of the issue
c. Person responsible for resolution
d. Description of the resolution and date completed

6. Corrections and Re-test

a. Any changes made during FAT that may affect previously completed tests require that those tests be re-performed and documented.

7. Correction after FAT

a. All problem corrections and subsequent re-check should be executed during the FAT. If this is not possible then rectification can be undertaken after the FAT, if mutually agreed to by the OWNER and CONTRACTOR. Problem correction after the FAT should include the following:

1) Identification of re-work needed

2) Action plan/time schedule
3) Person responsible for completing task
4) Execution of re-work
5) Re-test of anything affected by the re-work. Need for OWNER witness of re-test to be agreed upon with CONTRACTOR
6) Notification of completion
7) Acceptance of re-check

8. Documentation of FAT

a. FAT Report including:

1) Attendees
2) Tests performed
3) Open issues and agreements for their resolution
4) OWNER approval to ship or other disposition of the system

b. FAT Documentation including:

1) Signed copies of test function plans
2) Date and sign all documents generated during FAT
3) FAT punch list with status of each item
4) Document the actual hardware and software (including versions) tested
5) Document all configurable parameters used for testing
6) Backup copies of the final complete system and software
7) Color copies of all applicable graphic displays
8) Update of all system-related documentation to reflect the FAT complete status of the system

F. The CSI shall submit completed and signed FAT report and documentation to the ENGINEER within 5 days of completion of the FAT. The protocols, reports and documentation shall be submitted electronically in PDF format.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CONTROL SYSTEM

A. The proposed control system at the FAT shall use simulated equipment, simulation code, and emulators where necessary for successfully testing functional capabilities of the system.

B. The CSI shall verify throughout the FAT procedure that the functionalities of the entire system is in accordance with the operational requirements as established in the contract documents and the approved detailed design.

C. Factory Acceptance Test Completion

1. FAT shall be considered complete when all the required functions have been demonstrated and verified to be in accordance with the FAT plan and specifications. Upon successful completion of the FAT procedure, the CSI shall sign the test results/report. FAT report and documentation shall be delivered to the ENGINEER. The CSI shall be granted permission to ship the system and equipment to the field site after the completion of FAT.

D. The location for the FAT shall be facilitated by the CSI for as long as it is needed to successfully complete the entire FAT and resolve all encountered deficiencies to the satisfaction of the ENGINEER and the OWNER.

E. All interconnections shall be on the same type of media as proposed for the final installation. Shorter runs are acceptable.

F. All tag numbers, description of tags, I/O addresses for PLC and for SCADA shall be fully configured prior to FAT and tested during FAT.

G. Safety

1. All testing shall be done in accordance with NFPA 70E.

3.02 MINIMUM STAFFING

A. The CSI shall provide the following minimum staffing available during the FAT:

1. Control Systems Integrator – Project Manager or Lead Engineer/Programmer
2. 1 - PLC/HMI Programmer

END OF SECTION

SECTION 26 99 20
COMMISSIONING FOR THE CONTROLS SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Requirements for the CONTRACTOR to provide commissioning and installation services.

B. Requirements for the CONTRACTOR to provide labor, materials, tools, and testing equipment to commission controls, networking, and communications related equipment and systems.

C. Requirements for the CONTRACTOR to perform associated testing of electrical systems, wiring, equipment, and grounding.

1.03 CITED STANDARDS

A. National Fire Protection Association (NFPA):

1. 70, National Electrical Code (NEC)
2. 70E Standard for Electrical Safety in the Workplace 2012

B. The Institute of Electrical and Electronics Engineers (IEEE)

C. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

A. Commissioning of any system shall not begin until permission is granted by the ENGINEER and CITY.

B. Comply with NFPA 70E.

C. The CITY shall have the option to witness and participate in the entire commissioning and integration process.

1.05 QUALITY CONTROL

A. The Integrator shall submit weekly and monthly commissioning progress reports to the ENGINEER. The report formats shall be developed by the Integrator.

B. Test Equipment Traceability:

1. The Integrator shall have a calibration program which maintains applicable test instrumentation and equipment within rated accuracy and within their calibration time limits.
2. Equipment and instruments used to evaluate electrical performance shall be calibrated to a secondary standard traceable to the National Institute of Standards and Technology (NIST).
3. Test equipment operating instructions and procedures shall be with the test equipment.
4. A copy of test equipment calibration certificate or calibration sticker must be with equipment at all times to be available for inspection.

1.06 SUBMITTALS

A. The following submittals shall be made during commissioning:

1. Progress reports

B. A commissioning report shall be submitted upon the completion of commissioning activities to notify the CITY and ENGINEER of the milestone and the readiness for Site Acceptance Testing (SAT). The commissioning report shall include, but not be limited to, the following:

1. Completed commissioning checklists
2. Completed punch lists
3. Calibration data sheets
4. Drawings and manuals
5. Training

PART 2 – PRODUCTS

2.01 GENERAL

A. Where equipment is to be retained but rewired that equipment and associated wiring shall be subjected to testing new equipment and wiring procedures.

B. The start-up service personnel must follow job site electrical safety requirements, installation standards and electrical testing standards. Adhere to OSHA safety practices for the entirety of commissioning.

C. CITY designated representatives may witness all integrated system commissioning activities.

D. In addition to the requirements of this section, the installation and commissioning will comply with all applicable requirements of the RFP.

2.02 PRODUCT NAME

C. A partial list of systems and equipment to be commissioned shall include but not limited to:

1. Panel devices
2. All modifications and associated devices
3. PLC
4. OIT
5. Communication equipment
6. Remote Access for pump station monitoring data
7. Graphic Displays in OIT

PART 3 – EXECUTION

3.01 GENERAL

A. The commissioning and installation shall be considered complete by the ENGINEER upon successful installation of control equipment and execution of the commissioning requirements listed herein. The Integrator shall be granted permission to begin the Site Acceptance Testing.

B. CONTRACTOR shall be responsible for any damage to equipment or material due to improper testing or commissioning and shall replace or restore to original condition any damaged equipment or material.

C. All systems, equipment, and rooms shall be commissioned in a complete manner as possible to ensure a complete working control system, network and communication system.

D. The intent of commissioning is to start-up equipment or systems and prepare them for performance site acceptance testing. Care should be taken to ensure continuous and reliable operation of the booster pumping station systems at all times.

E. Commissioning of all systems listed to include but not be limited to:

1. All wire, cable, equipment, and systems installed or connected under control systems upgrade contract shall be tested to assure proper installation, setting, connection, and functioning in accordance with the drawings, specifications, and the manufacturer's recommendations. The intent herein is that field testing be extensive and complete as specified, to provide assurance of correct installation and operation of equipment.
2. All tests and inspections recommended by the equipment manufacturer shall be included, whether required by these specifications or not, unless specifically waived in writing by the ENGINEER.

3.02 COMMISSIONING AND SYSTEM INTEGRATION

A. Commissioning shall be performed with all inter-related systems operating. In general, integrated system commissioning shall be operated through all modes of operation (normal, emergency, interruption to the incoming services, manual operations). Verification of each mode in the sequences of operation is required.

B. If a problem is detected while conducting commissioning, the problem will be identified and reported to the CONTRACTOR for diagnosis and correction. The failed portion shall be repeated after the repairs are completed.

C. A combination punch list/checklist shall be maintained by the Integrator in spreadsheet format to monitor and track equipment commissioning and installation. The spreadsheet shall be an integral part of the weekly report documentation and must be included with final report.

3.03 CERTIFICATION

D. Notification of Completion of Work

1. Prior to acceptance of Work, the CITY shall request from the CONTRACTOR a written notification certifying that:

a. Work has been completed in accordance with Contract Documents.
b. Work has been inspected for compliance with Contract Documents.
c. Work is ready for final inspection and site acceptance testing.

B. Final Walk-Thru

1. After receipt of the notification of completion of work, the ENGINEER or Project Manager will conduct a final walk-thru with the participation of the CITY,

CONTRACTOR, ENGINEER and other appropriate project team members to verify the status of the completion

C. Final Punch List

1. Should the ENGINEER consider that the Work is incomplete or defective:

    a. The CITY will notify the CONTRACTOR in writing, by form of a final punch list, listing the incomplete or defective Work.
    b. The CONTRACTOR will take immediate steps to remedy the stated deficiencies and send a second or subsequent written certification to the ENGINEER stating that the Work is complete.
    c. The ENGINEER or Project Manager will re-inspect the Work.

2. Upon satisfaction that all the work is complete and all items in the Final Punch List addressed to the satisfaction of the ENGINEER, the CITY and CONTRACTOR will sign-off on the final punch list indicating concurrence that the work is complete.

D. Manuals and Records

1. After final walk-thru and sign-off on the final punch list have been achieved the CONTRACTOR releases to the CITY the following manuals and records kept, updated and/or developed during the project:
2. Final documentation as specified in Section 26 90 00.
3. Training session forms.
4. Copies of all punch lists.

3.04 TRAINING

E. After the completion of commissioning and installation, designated CITY personnel shall be trained in the operation and maintenance of all equipment and systems related to the project.

B. Training shall consist of a formal one-day session wherein all procedures necessary to operate and maintain equipment and systems on a continuing basis are explained in full detail. Hands-on operations and maintenance tasks shall be executed to ensure that all aspects of the training are fully understood.

C. Training shall be conducted on-site by the CSI and shall be offered to accommodate up to 12 persons.

D. Training times shall be determined and coordinated by the CITY.

END OF SECTION

SECTION 26 99 30
SITE ACCEPTANCE TESTING (SAT)

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Site acceptance tests shall be performed after the system is delivered, installed and commissioned at the site. SAT shall demonstrate proper installation and functionality of the system after delivery and installation at the site.

B. The CONTRACTOR shall coordinate SAT testing with all involved parties including CITY, ENGINEER, and Control System Integrator for all labor, tools, material, and testing equipment to perform and document SAT.

C. The CONTRACTOR shall submit SAT protocol documents prior to the commencement of SAT. SAT protocol documents shall include:

1. SAT plan
2. SAT test schedule
3. Document for recording punch list items

D. SAT plan shall include but not limit testing of the following systems:

1. All booster/pumping system control equipment
2. All sodium hypochlorite system control equipment
3. PLC control logic for booster/pumping equipment
4. PLC interface with other systems
5. Communication equipment configuration and operation.
6. OIT graphic displays
7. All generator system control equipment

1.03 CITED STANDARDS

A. National Fire Protection Association (NFPA):

1. 70, National Electrical Code (NEC)
2. 70E Standard for Electrical Safety in the Workplace 2012

B. The Institute of Electrical and Electronics ENGINEERs (IEEE)

E. International Society of Automation (ISA)

1.04 NOTED RESTRICTIONS

A. Site Acceptance Testing shall not begin until permission is granted by the ENGINEER and City.

B. Comply with NFPA 70E.

C. The City shall have the option to witness and participate in the entire site acceptance testing process.

1.05 QUALITY CONTROL

A. The Control System Integrator shall generate the Site Acceptance Test (SAT) protocol document.

B. The SAT protocol shall be based on a revised FAT protocol document to ensure consistency and efficiency.

C. The SAT procedures shall be submitted and approved by the CITY and ENGINEER prior to the commencement of SAT.

D. The Control System Integrator shall certify to the ENGINEER that the entire control system that are being installed under the control system upgrade are ready for the SAT prior to the initiation of the SAT.

E. The SAT shall be declared a failure and a retest shall be required if any of the following occur:

1. Failure to meet the requirements of system hardware operational testing as specified in this Section.
2. Failure to meet the acceptance criteria as established in the approved Site Acceptance Test Procedures.

F. Prove-In Period

1. The SAT shall be concluded with a 30 day “prove-in” period to allow time for any errors or omissions in the integration work to be revealed.
2. The CONTRACTOR shall correct any errors revealed in the “prove-in” period at no cost to the City and as part of the warranty requirements.

1.06 SUBMITTALS

A. The CSI shall submit the detailed SAT plan to the ENGINEER, to include but not limit testing for:

1. Control Panels
    a. Visual inspection, dimension, access for maintenance
    b. Bill of material verification
    c. Manufacturer's documentation: Data sheets, User's Manual, etc.,
    d. Recommended spare parts list
    e. Spare parts received
    f. Labelling of components
    g. Warning labels, if applicable
    h. Wiring
        1) Visual inspection for cable entry, routing, support
        2) Termination,
        3) Segregation by voltages/type
        4) Review of vendor's reports of tests and checks, if applicable
2. Software licenses and version including firmware received and installed
    a. System Energization
        1) Initialization of controller(s)
        2) Software download
        3) Diagnostic checks
3. Hardware Redundancy and Diagnostics, if applicable
    a. OIT
        1) Check latest version of graphics are installed
4. Control Logic
        1) Check latest revision is installed
5. Discrete I/O
6. Analog I/O
7. Hard-wired Interlocks
8. PLC logic Interlocks
9. Alarms
10. Graphics – Operator interface capability
11. Tag numbers and database

12. Communication equipment and configuration

    a. Communication performance

13. Control system interface to other systems
14. Non-standard operating conditions shall be tested

    a. Loss of power for each component
    b. Communications failure
    c. Removal of each PLC card
    d. PLC failure

B. SAT Schedule

    1. The CSI shall develop a schedule for performing Site Acceptance Tests based on project schedule.

C. Site Acceptance Test Punch List

    1. Any incomplete work or non-conformances detected during SAT shall be recorded on SAT Punch List. Punch list items shall be categorized as follows:

        a. Immediate: SAT shall be paused for rectification and SAT shall continue after rectification.
        b. On-going: Rectification during SAT and will be completely rectified at the end of SAT. This category is used typically for multiple instances of the same issue which will be rectified during FAT as the issues are encountered.
        c. Repeat: SAT should be repeated after rectification and before completion of SAT.
        d. Future: Issues that are beyond the scope of the project but something that should be addressed in the future.

    2. Fat Punch List at a minimum shall include:

        a. Reference to applicable FAT Test Plan requirement
        b. Description of the issue
        c. Person responsible for resolution
        d. Description of the resolution and date completed

    3. Corrections

        a. Any changes made during SAT during rectification of punch list items, shall be documented. Any changes that may affect previously completed tests require that those tests be re-performed and documented.

    4. Correction after SAT

a. All problem corrections and subsequent re-check should be executed during SAT. If this is not possible then rectification can be undertaken after the SAT, if mutually agreed to by the City and CONTRACTOR. Problem correction after the SAT should include the following:

1) Identification of re-work needed
2) Action plan/time schedule
3) Person responsible for completing task
4) Execution of re-work
5) Re-test of anything affected by the re-work. Need for City witness of re-test to be agreed upon with CONTRACTOR
6) Notification of completion
7) Acceptance of re-test

5. Documentation of the SAT

a. SAT Report including:

1) Attendees
2) Tests performed
3) Open issues and agreements for their resolution
4) City acceptance of the system

b. SAT Documentation including:

1) Signed copies of test function plans
2) Date and sign all documents generated during SAT
3) SAT punch list with latest status of each item
4) Document the hardware and software (including versions) tested
5) Document all configurable parameters used for testing
6) Backup copies of the final complete system and software
7) Document system loading observed during the test and spare capacity
8) Provide an index and color graphics of any displays modified or added during SAT
9) Update of all system-related documentation to reflect the SAT complete status

6. SAT Completion

a. SAT shall be considered complete when all of the required functions have been demonstrated and verified to be in accordance with the SAT plan and specifications. Upon successful completion of the SAT procedure, the CSI shall sign the test results/report. SAT report and documentation shall be delivered to the City/ENGINEER.

D. The SAT protocols shall be submitted a minimum of 14 days prior to anticipated testing start date.

E. Site acceptance test procedures document shall include all the tests included in the FAT test protocol requirements defined in Section 269910.

F. Only approved protocols shall be used for recording the test results during the SAT. The test protocols shall include pass/fail criteria and spaces for the ENGINEER and CONTRACTOR/Integrator sign-off.

G. The Integrator shall submit completed and signed SAT report and documents to the ENGINEER/City within 5 days of completion of the SAT. The report and documents shall be submitted electronically in PDF format.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CONTROL SYSTEM

A. The CONTRACTOR shall be responsible for coordinating the SAT of the proposed control system.

B. The Control System Integrator shall verify, throughout the site acceptance test, that the functionalities of all systems under this contract are in accordance with the operational requirements as established in the Contract Documents and the approved Detailed Design.

C. SAT shall be considered complete when all of the required functions have been demonstrated and verified to be in accordance with the SAT plan and specifications. Upon successful completion of the SAT procedure, the CSI shall sign the test results/report. SAT report and documentation shall be delivered to the ENGINEER.

D. Prove-In Period

1. The SAT shall be concluded with a 30 day “prove-in” period to allow time for any errors or omissions in the integration work to be revealed.
2. The CONTRACTOR shall correct any errors revealed in the “prove-in” period at no cost to the City and as part of the warranty requirements specified in Section 26 90 00.

E. Safety
1. All testing shall be done in accordance with NFPA 70E.

3.02 MINIMUM STAFFING

A. The CSI shall provide the following minimum staffing available during the FAT:

1. Control Systems Integrator – Project Manager or Lead ENGINEER/Programmer
2. 1 - PLC/HMI Programmer

END OF SECTION

SPECIFICATION 33 06 00
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor shall provide all hangers, supporting devices and appurtenances shown, specified or required for pipes, fittings, valves and other in-line equipment.

B. Included in this classification are rod hangers; clevis hangers, spring hangers; stanchion, roller and pipe pole supports and saddle stands; supports of structural steel; concrete saddles, concrete anchor blocks and bases, and all necessary guides, restraints, fastening devices, anchor bolts, pipe anchors and appurtenances.

C. Contractor shall provide all temporary pipe supports required during construction.

D. Contractor shall design all piping support systems in accordance with the requirements of this Specification unless otherwise shown or specified.

1.02 RELATED SPECIFICATIONS

A. Specification 03 30 00 – Cast-in-Place Concrete

B. Specification 09 90 00 – Painting and Coating

C. Specification 21 93 00 – Fire Sprinkler Systems

1.03 REFERENCES

A. The Manufacturers Standardization Society of the Valve and Fitting Industry:

1. MSS SP-58 – Pipe Hangers and Supports - Materials, Design and Manufacture.

2. MSS SP-69 – Pipe Hangers and Supports - Selection and Application.

3. MSS SP-89 – Pipe Hangers and Supports - Fabrication and Installation Practices.

4. MSS SP-90 – Guidelines on Terminology for Pipe Hangers and Supports.

B. Federal Specification, FS W-H-171 - Hangers and Support, Pipe.

C. Underwriter's Laboratories, Inc., Standard UL-203 - Pipe Hanger Equipment.

D. ASTM A 36 – Standard Specification for Carbon Structural Steel.

E. ASTM A 48 – Standard Specification for Gray Iron Castings.

F. ASTM A 276 – Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

G. ASTM A283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.

H. ASTM A778 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

I. ASME - B31.1 – Power Piping.

J. IBC – International Building Code, Latest Edition. Section 1621

K. EJMA – Expansion Joint Manufacturers Association.

L. NFPA 13 – Installation of Sprinkler Systems.

M. ASCE 7, latest edition -Section 9.6.

1.04 DESIGN REQUIREMENTS

A. Contractor shall provide hangers and supports of sufficient strength to maintain the pipelines and appurtenances in proper position and alignment under all operating conditions.

B. Contractor shall provide the services of a State Registered Professional Engineer to design the supports for all pipelines and appurtenances, for all weights, forces and applied pressures. In the design of hangers, supports and anchors, unless otherwise shown or specified, pipe pressures shall be the maximum test pressures specified for pipelines carrying gases and twice the maximum test pressures specified for pipelines carrying liquids. The pipe support designer shall have a minimum of 5 years experience in the design of pipe supports and have completed at least 5 successful pipe support projects of equal complexity as the systems specified.

1. Pipe support design shall include load and movement calculations.

2. The following loads shall be included in pipe support design and pipe stress analysis:

a. Gravity Force, including weight of pipeline and appurtenances, contents, insulation, etc.

b. Thermal Expansion Force developed by the restraint of free end displacement of the piping.

c. Hydrostatic Forces developed by internal pressure during operation of the piping system.

d. Loading due to expansion joint reaction forces.

3. Supports, guides and anchors for flexible couplings and expansion joints shall be in accordance with the coupling and joint manufacturer's specification and the standards of the Expansion Joints Manufacturers Association.

4. Wherever possible, pipe supports shall be designed using manufacturer's standard catalog products.

5. Hangers and Supports for piping systems subject to thermal expansion and contraction, or to similar movements imposed by other sources, shall be designed to provide flexibility, and pipe stress analysis shall be provided.

6. Where resonance with imposed vibration and/or shock occurs during operation, suitable dampeners, restraints, anchors, etc., shall be added to remove those effects.

7. Occasional load calculations and pipe stress analysis shall be provided where required by the Specifications, Building Codes or Standards. Occasional loads include:

   a. Pressure waves produced by sudden changes in fluid momentum, commonly referred to as water hammer.

   b. Wind, snow or ice loads.

   c. Safety valve thrust loads

8. Stressers in hangers, rods and brackets shall be in accordance with Table 2 of MSS-SP-58.

C. All hangers and supports shall conform to the applicable requirements of ASME B31.1, MSS SP-58, SP-59, SP-69 and SP-90, except as modified herein, and be of standard manufacture wherever possible, and best suited for the service required.

D. Unless otherwise approved, all hangers, supports and concrete inserts shall be listed with Underwriters' Laboratory, Inc.

E. General Requirements:

1. Pipe and appurtenances connected to equipment shall be supported in a manner to prevent any stress being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, certification shall be submitted stating that requirements have been complied with.

2. Where practicable, piping shall be run in groups and parallel to building walls. A minimum clearance of one inch shall be provided between pipe and other work.

3. Hangers or supports shall be provided at all locations where piping changes direction.

4. Hangers and supports shall be capable of adjustment after placement of piping.

5. Types of hangers and supports shall be kept to a minimum.

6. Suspended or supported ductile iron pipe shall have a hanger or support adjacent to each hub or flanged end.

7. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.

8. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.

9. Contact between dissimilar metals shall be prevented by use of copper plated, rubber or vinyl coated hangers or supports.

10. Hangers and supports shall provide for expansion and contraction throughout the full operating temperature range.

11. Any required pipe supports, for which the supports called for in this Specification are not applicable, shall be fabricated or constructed from standard stainless steel shapes, concrete and anchor hardware, and shall be subject to the approval of Engineer.

12. Where hanger or support spacing does not correspond with joist or rib spacing, structural steel channels shall be attached to joists or ribs, and the pipes suspended therefrom.

13. All hanger rods shall be double nutted at each hanger or support.

14. All threaded assemblies shall be double nutted or provided with pinned nuts. Alternately, tack welding of bolted assemblies may be acceptable unless provisions for vertical adjustment is required.

15. Except where otherwise shown or required, horizontally valves 6-inches and larger shall be supported on each side of the valve, by pipe hangers or supports.

16. At all flexible couplings, supports shall be placed on each side and as close to the coupling as possible. Supports shall be the guide type which prevent axial movement from resulting in pipe deflection and misalignment.

17. Supports, anchorage and guidance for grooved end pipe shall be in accordance with the applicable sections of these specifications and the recommendations of the manufacturer.

1.05 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Division 1.

B. Contractor shall submit the following for approval:

1. Name and qualifications of the support and hanger engineer.

2. Detailed Working Drawings showing all hangers and supports for each piping system. Working Drawings shall show location, installation, material, loads, forces, stresses and deflections of all hangers and supports. Reaction forces imparted to structures to which hangers and supports are attached shall be shown.

C. Contractor shall submit the following product information for approval:

1. Manufacturer's catalogs and engineering data on all hangers and supports.

2. Load ratings.

3. Materials.

4. Installation details.

D. Contractor shall submit all drawings and specified or required design calculations, signed and sealed by a State Registered Professional Engineer.

E. Contractor shall provide detailed drawings of each pipe support. Each drawing shall contain enough information to verify the pipe support design and to allow the manufacture of the device. At a minimum, the Contractor shall submit:

1. Scaled details of the device with dimensions.

2. A table of applied forces and moments.

3. A complete bill of materials.

4. An isometric showing the applied forces and moments.

5. Shop and field welds.

F. Each submittal shall have the following:

1. A unique identification number and revision level.

2. Stamp of a State Registered Professional Engineer experienced in pipe support design as specified in Article 1.05B.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment and materials shall be delivered to the site to insure uninterrupted progress of the Work. Pipe hanger inserts which are to be embedded in cast-in-place concrete shall be delivered in ample time not to delay the Work.

B. Equipment and materials shall be stored to permit easy access for inspection and identification, and shall be kept in covered storage off the ground, using pallets,

platforms or other supports. They shall be protected from condensation, corrosion and deterioration.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pipe hangers, supports and appurtenances shall be standard products of the manufacturers listed in the Specifications.

B. Each type of hanger and support shall be the product of a single manufacturer.

2.02 MATERIALS

A. Materials for hangers and supports of metallic construction shall conform to ASME B31.1 and to the following standards:

1. Galvanized Structural Steel, ASTM A 36 and A 283.

2. Iron Castings, ASTM A 48 (Class No. 35).

3. Stainless Steel, ASTM A 276

   a. Type 316 stainless steel for non-welded items.

   b. Type 316L stainless steel for welded or fabricated items.

   c. Tensile Strength - 70,000 psi minimum.

   d. Yield Strength - 25,000 psi minimum.

   e. Elongation in 2 inches 35%.

   f. Reduction of area 45%.

4. Stainless Steel Pipe and Tube, ASTM A 778, Type 316L stainless steel.

B. Pipe supports, hangers, brackets, guides, restraints, rods, bolts, nuts and anchors shall be Type 316 stainless steel. Concrete inserts shall be of malleable iron with galvanized finish.

C. Pipe rolls, including stands and bases, shall be of cast iron, hot-dipped galvanized conforming to ASTM A123.

D. Only new materials shall be provided.

E. Hangers and supports shall conform to MSS-SP-58, Table 2.

F. Proprietary fiberglass reinforced plastic supports and hangers for use with small diameter chemical and thermoplastic pipe shall be as specified in the Specifications and approved by the Engineer.

2.03 HANGERS AND SUPPORTS

A. Hangers and supports where shown shall be in accordance with the Contract Drawings. Hangers and supports not shown shall comply with MSS SP-58.

B. All hangers and supports shall allow minimum 3-inches of vertical adjustment.

C. Hangers and Supports shall be of the following types:

1. Hangers for Single Pipes:

a. Single pipes shall be supported by hangers suspended by rods from structural steel members, inserts in concrete ceilings and beams, bottom of trapeze hangers and wall mounted steel angle brackets. The strength of the rod shall be based on its root diameter.

b. Except for piping subject to thermal expansion and contraction or as otherwise specified in the Specifications, pipe hangers shall be adjustable clevis type MSS SP-58 Type-1.

c. Piping subject to thermal expansion and contraction shall be supported on rollers.

2. Hangers or Supports for Multiple Pipes:

a. Multiple pipes, running parallel in the same horizontal plane, and adjacent to each other, shall be suspended by trapeze type hangers or supported on wall brackets. Trapeze hangers shall consist of channel sections supported from threaded rods or attached to concrete walls, columns or structural steel support members.

b. Except as otherwise specified herein, pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets, shall be anchor or pipe chairs as required.

3. Supports for Single Pipe:

a. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods specified herein or as shown on the Contract Drawings.

b. Pipes shall be supported by adjustable stanchions, pipe saddle or roll supports with "U" bolts. Stanchions shall provide at least 4-inches adjustment and be flanged-mounted to floor.

c. Stanchions and saddle stands shall be of Type 316L stainless steel.

d. Pipe pole supports for pipe runs above ground, out-of-doors, and where otherwise required, shall consist of a suitable length of stainless steel pipe set upright in at least four feet of concrete; two stainless steel angles secured to the top of the pipe, at right angle

and on each side; a stainless steel plate welded to the top of the angles to serve as a horizontal support for the pipes. Supports shall be provided with attachments in the form of stands, clamps, rolls, rods or similar devices of the screw adjustable type in the vertical direction.

e. Where specified or shown, column supports of built-up welded stainless steel shall be provided, as approved by the Engineer.

f. Pipe rollers shall be cast ductile iron, unless otherwise shown or specified in the Specifications. Hardware and appurtenances shall be stainless steel.

4. Wall Supported Pipes: Single or multiple pipes located adjacent to walls, columns or other structural members, and an excessive distance from ceilings or underside of beams, shall be supported using stainless steel wall brackets, MSS SP-58 Type 32 or 33. Where pipes rest on top of bracket pipe supports, attachments shall meet the requirements specified under Paragraph 2.b above.

5. Supports for Base Elbows: Where pipes change direction from horizontal to vertical through a bend, a welded or cast base anchor support shall be installed at the bend to carry the load.

6. Supports for Vertical Pipes: Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be MSS SP-58 Type 42 or 8. Insulation shall be removed from insulated pipes prior to installing riser clamps.

7. Supports for Pipelines with Thermal Expansion:

a. Pipe rolls for single rod hangers: Stainless steel frame construction, ductile iron roller and stainless steel roller rod provided with threaded nuts; vertical adjustment permitted; for pipe sizes 6 inches or less unless otherwise approved.

b. Pipe rolls for double rod hangers: Ductile iron roller, stainless steel roller rod, malleable iron threaded sockets which permit vertical adjustment.

8. Supports for Thermoplastic Pipes: All thermoplastic pipe attachments shall have a continuous bearing cradle or saddle on the lower 120 degrees of pipe circumference and a minimum length of one quarter pipe diameter, but not less than 6 inches nor more than 12 inches.

9. Supports for Copper & Brass Pipes: All copper and brass pipe supports shall be specifically manufactured for use with copper & brass pipe. Hangers shall be provided with a copper finish.

10. Concrete Supports:

a. Where pipeline or mechanical equipment is shown, specified or required to be supported on concrete supports, supports shall be as specified herein.

b. Concrete supports for equipment shall be of a size and mass that will resist all forces, both static and dynamic, which may be developed by the equipment.

c. Concrete supports for pipe, fittings, valves and appurtenances shall be designed to carry the weight of the pipeline and appurtenances. Cradles and anchor blocks shall safely withstand all stresses imposed by the pipelines, under all operating conditions. Concrete cradles shall be shaped to fit the contour of the pipe.

d. Concrete supports shall be anchored to the floor of main structures by doweling or other approved means. Anchor bolts, extension plates, saddle yokes and other hold-down devices in concrete bases shall be placed before pouring of concrete. Expansion bolts shall not be used on new concrete supports except with the specific approval of the Engineer.

e. Concrete supports shall be not less than Class 25 as specified in Specification 03 30 00 - Cast-in-Place Concrete.

2.04 ACCESSORIES

A. Hanger Rods:

1. Material shall be Type 316 stainless steel. Maximum allowable working stress shall be 5,800 psi, calculated based on the root diameter.

2. Rods shall have a square head nut on top and running thread on bottom end.

3. Hanger rods for pipe hangers shall be sized in accordance with the table located in 3.02, HANGERS AND SUPPORTS INSTALLATION.

B. Concrete Inserts, Attachment Plates and Clamps:

1. Hanger rods up to 7/8-inch diameter shall be attached to new concrete structures using concrete inserts MSS SP-58, Type 18. Inserts shall be malleable iron with galvanized finish. The use of steel inserts is prohibited. Design of the inserts shall permit the rods to be adjusted laterally in one plane and to lock the rod nut or head to the body. The inserts shall be provided with openings or recesses to receive reinforcing rods. To facilitate installation, slots shall be provided in the exposed flanges of the insert. Inserts shall be rated to safely carry the maximum load which can be supported by the hanger rod.

2. Hanger rods larger than 7/8-inch diameter shall be attached to new concrete by means of approved hook anchors as shown on the Contract Drawings.

3. Steel beam clamps shall be malleable iron and conform to MSS SP-58 Type 28 or 29 for wide flange or I-beams, and Type 20 for channel sections or where it is necessary to locate the hanger rod off the beam centerline.

4. Steel U-shape beam attachments welded to the underside of beams, and welded steel brackets fastened to structural steel columns, shall be subject to specific approval of the Structural Steel and Pipe Supports Working Drawings.

2.05 PIPE INSULATION PROTECTION

A. Contractor shall furnish steel protection saddles on all supports for insulated pipe.

1. For pipe sizes less than 12 inches in diameter, provide saddles of No. 14 U.S. gauge stainless steel curved 180 degrees for use with roller hangers or structural trapeze hangers and of No. 16 U.S. gauge stainless steel curved 120 degrees for use in clevis hangers. Saddles shall be at least 12-inches long. Saddle gripping side edges shall be turned up at least to the thickness of insulation.

2. For pipe 12 inches in diameter and larger, provide saddles of No. 12 U.S. gauge stainless steel with a welded centerplate to provide three-edge support. Saddles shall be at least as long as the pipe diameter, provide 120 degree coverage and have edge and centerplate depths equal to the insulation thickness.

2.06 SADDLES

A. Before placing the saddles, saddles shall be filled with either insulating cement or high density insulation cut to fit. For vapor barrier insulation, the barrier must be maintained; contact between hanger and support and bare pipe will not be permitted.

B. Anchors and sway braces shall be provided when required to hold the pipelines and equipment in position or alignment. Pipe anchors and braces for rigid fastening to the structures shall be attached to stainless steel anchor plates and anchor bolts set into the forms when placing concrete of new structures.

C. Anchors, guides and restraints shall be provided for the proper operation of pipeline expansion joints.

D. Cast iron anchors shall be provided with stainless steel straps on piping, except where anchors form an integral part of pipe fittings and couplings or where an anchor of special design is required or shown on the Contract Drawings.

E. All pipe anchors, guides and restraints shall be designed to conform to ASME B31.1.

2.07 INSPECTION

A. The City may elect to conduct shop inspections. The inspections may include but not be limited to: mechanical and chemical testing, material sampling, material certifications, traceability of parts, blasting and painting, visual and dimensional inspection, and free iron contamination check on steel parts.

PART 3 - EXECUTION

3.01 GENERAL

A. Hangers, supports, and accessories shall be located within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.

B. Hangers or supports shall be provided at all locations where piping changes direction.

C. Hangers and supports shall be located to prevent vibration or swaying and to provide for expansion and contraction.

D. Hangers rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.

E. Concrete embedded items shall be installed before concrete placement.

F. Embedded items shall be fastened securely to prevent movement during concrete placement.

G. Hanger and support units installation methods shall be in accordance with manufacturer's recommendations.

H. Hangers and supports shall be adjusted and grout placed to bring pipelines to specified elevations.

3.02 HANGERS AND SUPPORTS INSTALLATION

A. Supports and Hangers for Horizontal Pipes:

1. Supports and hangers for all piping shall be placed no farther apart than the table shown below, unless otherwise shown or specified. Tables are based on MSS SP-69 Tables 3 & 4. Spacing and capacities are based on water filled pipe plus 50 lbs. /ft. dead load. Closer hanger spacing may be required where additional valves and fittings increase the load.

RECOMMENDED HANGER SPACING AND ROD SIZE FOR STEEL PIPE[1,2,3]				
Nominal Pipe Size (inches)	**Maximum Span (feet)**	**Recommended Hanger Rod Sizes (single rod – inches)**	**Recommended Hanger Rod Sizes (double rod – inches)**	**Maximum Load Per Hanger (lbs.)**
3/4”	7	3/8”	3/8”	300
1”	7	3/8”	3/8”	300
1 1/4”	7	3/8”	3/8”	300
1 1/2”	9	3/8”	3/8”	300
2”	10	3/8”	3/8”	325
2 1/2”	11	1/2”	3/8”	350
3”	12	1/2”	3/8”	400
3 1/2”	13	1/2”	3/8”	450
4”	14	5/8”	1/2”	850
5”	16	5/8”	1/2”	950
6”	17	3/4”	5/8”	1075
8”	19	7/8”	5/8”	1350
10”	22	7/8”	5/8”	1750
12”	23	7/8”	3/4”	2200
14”	25	1”	7/8”	2500
16”	27	1”	7/8”	3075
18”	28	1”	7/8”	3700
20”	30	1 1/4”	1”	4425
24”	32	1 1/4”	1”	6050

Note 1: Based on MSS SP-69 Table 3 & 4.
Note 2: For hanger spacing greater than 10’-0”, many codes require pipe hangers to be spaced a maximum of every 10’ regardless of size. Check local codes. Local codes apply.
Note 3: Spacing and capacities are based on water filled pipe plus 50 lbs. /ft. dead load. Closer hanger spacing may be required where additional valves and fittings increase the load.

RECOMMENDED HANGER SPACING AND ROD SIZE FOR COPPER TUBING[1,2,3]		
Nominal Tubing Size (inches)	**Maximum Span (Feet)**	**Recommended Hanger Rod Sizes (inches)**
1/2”	5	3/8”
3/4”	5	3/8”
1”	6	3/8”
1 1/4”	7	3/8”
1 1/2”	8	3/8”
2”	8	3/8”
2 1/2”	9	1/2”
3”	10	1/2”
3 1/2”	11	1/2”
4”	12	1/2”
5”	13	1/2”
6”	14	5/8”
8”	16	3/4”
Note 1: Based on MSS SP-69 Table 3 & 4. **Note 2**: For hanger spacing greater than 10’-0”, many codes require pipe hangers to be spaced a maximum of every 10’ regardless of size. Check local codes. Local codes apply. **Note 3**: Spacing and capacities are based on water filled pipe plus 50 lbs. /ft. dead load. Closer hanger spacing may be required where additional valves and fittings increase the load.		

2. Additional spacing requirements:

   a. Ductile Iron, Steel and Stainless Steel Pipe:

      1) Maximum spacing in accordance with Table 3 of MSS-SP-69. The designer should check the capacity of the steel or building structure to which the hanger or support is attached, and adjust the maximum spacing accordingly.

      2) In addition, ductile iron pipe shall have a minimum of two supports per length and shall have a hanger or support adjacent to each end.

   b. Thermoplastic Pipe:

      1) Pipes up to 1-inch: 2 feet-6 inches center to center.

2) Pipes 1-1/2-inch to 3-inch: 4 feet-0 inches center to center.

3) Pipe 4-inch to 8-inch: 6 feet-0 inches center to center.

4) Pipes larger than 8-inch: 8 feet-0 inches center to center.

c. Cast Iron Soil Pipe: 5 feet-0 inches.

d. Tubing less than 1-inch diameter: In accordance with best piping practice and ASME B31.1, and as approved by the Engineer.

3. Additional supports shall be placed immediately adjacent to any change in piping direction, at equipment, and on both sides of valves, expansion joints and couplings.

B. Supports for Vertical Piping:

1. Riser clamp shall be placed under hub, fitting or coupling with approved solid bearing on steel sleeve.

2. Where riser clamps are used with plastic piping they shall be modified so as not to exert any compressive forces on the pipe.

3. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration. Maximum spacing shall not exceed 10 feet.

4. Base elbows or welded equivalent shall be provided at vertical piping bases.

5. Top support shall have a horizontal connection, and provide for pipe expansion.

C. Pipelines installed under plumbing work shall be spaced in conformity with the requirements of the International Building Code or as specified in the Specifications.

3.03 PAINTING AND COATING

A. Painting shall be in conformity with Specification 09 90 00 – Painting and Coating.

B. Surfaces of hangers and supports in contact with aluminum, brass, plastic and copper pipelines or pipeline equipment shall be protected with an approved plastic coating to prevent abrasion. Touch-up shall be provided in the field, as required. Coating shall be applied in accordance with the manufacturer's recommendations, and shall be free from spots and brush marks, to the satisfaction of the Engineer.

3.04 TESTING

A. All pipe support and restraining systems shall be installed and secured prior to the testing or activation of the pipeline on which they are installed.

B. All pipe support systems shall be tested for compliance with the Specifications. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. Tests shall include cycling the piping system to duplicate operating conditions. If any part of the pipe support system proves to be defective or inadequate, as evidenced by vibration or excessive movement, it shall be repaired or augmented at no additional cost to the City.

END OF SECTION

SECTION 33 07 60
PIPING AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all components of the system for identification of piping and equipment. The system includes the placing of identification signs and direction-of-flow arrows on all visible plant piping, the placing of nameplates on plant equipment and structures, and painting in color of all equipment and pipe, except stainless steel or aluminum surfaces, as shown on the Contractor's working drawings submitted under the related Specifications sections for equipment, piping and valves, and as required for a complete job.

1.02 PAYMENT

A. No direct payment will be made for these signs, flow charts or appurtenances; the cost must be included in the price bid for the piping system as specified in the Specifications.

1.03 REFERENCES

A. ASTM D523 - Standard Test Method for Specular Gloss

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents

C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics

D. ASTM D646 - Standard Test Method for Grammage of Paper and Paperboard (Mass per Unit Area)

E. ASTM D709 - Standard Specification for Laminated Thermosetting Materials

F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

G. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

H. ASTM D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

1.04 MANUFACTURER'S GUARANTEE

A. Provide the specified items from firms regularly engaged in the manufacture of identification devices of types and sizes required, with at least five (5) years' experience in manufacturing signs. In addition, the manufacturer shall guarantee the sign, in writing, against color fading, chipping, corroding or any other manufacturing defects for a period of ten (10) years.

1.05 SPARE PARTS AND ACCESSORIES

A. Furnish the following spare parts and accessories:

1. One set banding tools and banding accessories

2. One stainless steel banding strap, approximately 1000 ft.

3. One complete nameplate mounting assembly for every 20 nameplates installed

B. Provide all spare parts and accessories suitably boxed and marked for storage and reordering.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Construct fiberglass reinforced plastic identification signs and nameplates of 70 mils thick fiberglass reinforced plastic conforming to ASTM D709.

B. Provide fiberglass reinforced plastic process with a blemish free, low gloss surface of superior permanence and durability in the colors selected. Provide each identification sign and nameplate in two colors and with the legend specified. Provide the backside of the sign in black or some other uniform color.

C. Provide lettering made by silk screening or other permanent embedment of subsurface printed graphics in the material so as to produce a clear, legible sign. Do not place lettering, symbols or markings containing the name of the manufacturer on the signs. The contract number and the year of the contract as given on the Contract Drawings may be placed in small lettering on the front of the sign, if approved by the Engineer.

D. Provide signs for piping and valve identification with two 3/8 inch diameter grommet-protected holes located on the long side center line, the center of the hole to be ½ inch from the edge. Provide nameplates for equipment and structures with four 3/8 inch diameter grommet-protected holes, the center of the hole located ½ inch away from the edges. Provide all holes with suitable brass or stainless steel grommets.

E. Construct all signs and nameplates in conformity with ASTM D523, D638, D646, D790, D792 and D5420.

2.02 DIMENSIONS OF SIGNS AND TAGS

A. Provide identification signs and nameplates rectangular in shape and of the dimensions specified below. A dimensioned tolerance of plus or minus 1/16 inch is permissible.

TYPE OF SIGN	Sign Dimensions (Width x Length)
NAMEPLATES -	
1. Equipment and structures	3-1/2 x 12 inches

2.03 LETTERING OF SIGNS

A. Perform all lettering and numbering on identification signs and nameplates in block style in size and spacing to suit the size of sign, as approved by the Engineer.

B. Unless otherwise approved, limit the legend on pipe identification signs to one line and to a total of 12 letters and spaces, and the legend on equipment nameplates to two lines and a maximum of 35 letters and spaces.

C. Submit samples of the lettering to be used for fiberglass reinforced plastic signs to the Engineer for approval before manufacturing begins. Such samples must show the height, width and spacing of letters and numbers for any three (3) legends of ten or more letters and spaces as listed in Article 2.06.

2.04 CHEMICAL RESISTANCE

A. Provide fiberglass reinforced plastic signs resistant to abrasion, impact, corrosion, and the following acids, alkalis, salts and solvents in accordance with ASTM D543:

1. 10% citric acid
2. 5% acetic acid
3. 3-30% sulfuric acid
4. 10% ammonium hydroxide
5. 10% sodium chloride
6. turpentine
7. mineral spirits
8. heptane
9. kerosene

10. ethyl alcohol

11. ethyl acetate

12. transformer oil

13. heavy duty detergents

14. water

B. Submit certification on acid resistance to the Engineer prior to installation.

2.05 COLORS

A. Code pipeline signs and equipment nameplates and finish coats of paint for pipe lines and equipment in basic colors.

B. Provide brilliant colors, distinctive shades matching as closely as possible (without custom color blending) the following basic colors as specified by the Munsell Color System (MN):

Table Of Standard Colors	
Color	Munsell Number
White	MN - N8.8/
Yellow	MN - 4Y7.5/12.8
Orange	MN - 0.5 YR 4.6/12.2
Red	MN - 7R 3.6/12.7
Brown	MN - 2.5 YR 4.2/4.3
Gray	MN - 2.5PB 5.8/1.7
*Charcoal	MN - 6B 5/0.4
Black	MN - N1/
Blue	MN - 3PB 3.3/7.4
Green	MN - 8G 4.4/6.2
* Provide color "Charcoal" for paints equivalent to MN - N 3.75.	

C. Provide identification signs for pipelines of all sizes, mechanical equipment, sluice gates and valves in the color combinations specified below under "General Color Code".

GENERAL COLOR CODE		
	COLORS	
Service Line	Letters	Background
1. HEATING, AND VENTILATING (Equipment and Ductwork)	Green	Charcoal

D. Provide vents and drains of the same color combination as the contents of tanks and equipment vented and drained.

2.06 ARROWS

A. Make direction-of-flow arrows for attachment to pipe identification signs from No. 16 U.S. gauge Type 316 stainless steel, the full width of the sign. Make the arrow head with a tapered point, about 90 degrees at the apex, extending one half of the sign width from the sign edge and one half of the sign width extending under the sign. Finish all edges of the arrow. Make point with a radius of 1/4 inch for the 3-1/2 inch wide sign and a radius of 3/16 inch for the 1-1/2 inch wide sign. Punch detents on the arrows to prevent twisting of the point. Drill one hole in the arrow in alignment with the hole in the pipe identification sign so that both sign and arrow can be mounted with the same screw and bracket.

B. Submit sample direction-of-flow arrows for both sizes of pipe identification signs to the Engineer for approval before installation.

2.07 NAMEPLATES

A. Provide nameplates for equipment and structures in the same color combination as the medium they service. Legends for nameplates must follow the terminology shown. Provide numbering system as described in the Operation and Maintenance Manual.

B. The following is a representative list, not necessarily complete, of nameplate legends with appropriate color combinations to which the equipment identification number must be added:

		NAMEPLATES	
Legend		Color Code	
First Line (1)	Second Line (2)	Lettering	Background

NAMEPLATES			
Legend		Color Code	
First Line [1]	Second Line [2]	Lettering	Background
FANS	**	White	Charcoal
ELECTRIC HEATERS	**	White	Charcoal
AIR CONDITIONING UNIT	**	White	Charcoal

[1] Nominal limit of 18 letters, numerals and spaces.
[2] Nominal limit of 17 letters, numerals and spaces.
*Where equipment is mounted on roofs or where exposed to the public view, such as in lobby or office areas, the color will be selected by the Architect.

**The legend on these nameplates also includes the appropriate six-digit numeral and letter designation for such equipment and structures as specified by the Operation and Maintenance Manual.

** The legend on these nameplates also includes the appropriate tag number as specified by the Operation and Maintenance Manual.

2.08 ADDITIONAL SIGNS AND NAMEPLATES

A. In addition to the legends specified above, the Engineer may order the Contractor to furnish and install additional identification signs, arrows and nameplates at no additional cost to the City. Such additional signs may be requested near completion of the work and will be limited to no more than five (5) signs for each of the five types specified in Article 2.02. Conform legends and color combinations for additional signs to the requirements specified.

2.09 DUCTWORK

A. All ductwork shall be identified by plastic markers not less than 4 inches high in a color in contrast to the surface on which it is mounted. The markers shall be fastened to the ductwork with sheet metal screws or machine screws and hex nuts. Markers shall indicate system title function. Duct markers shall indicate area served, function, i.e., supply, return or exhaust and direction of flow.

B. Duct markers shall be located not more than 50 feet apart on all mains and branches. Markers shall be placed on ducts on each side of the wall or floor through which they pass. Markers shall also be placed adjacent to access panels. All markers shall be so located as to be clearly visible to a person standing on the floor.

PART 3 - EXECUTION

3.01 LOCATION

A. Locate identification signs for piping along straight line runs at intervals of not more than 30 feet, near valves, branches and junction points and where pipes pass through walls or ceilings. Place direction-of-flow arrows as shown or required. Locate signs on large valves on or adjacent to the valve itself. Place all piping identification signs so as to be easily visible from operating locations. Locate nameplates on equipment bases and on structures at readily visible levels in such positions relative to the equipment and structures so as to prevent damage to the nameplate.

3.02 MOUNTING

A. Mount identification signs and arrows on piping parallel and tangent to the pipe and valves by fastening with screws, plastic or fiber washers, threaded brackets and banding straps and seals. Provide screws and brackets of stainless steel with 5/16 - 18 American Standard Coarse Threads; provide No. 25 U.S. gauge stainless steel, 3/4 inch wide bands.

B. Where pipe is insulated, use care in mounting the signs so to prevent the banding straps from crushing the insulation.

C. Provide mounting assembly "Steelbinder" strapping unit as manufactured by A.J. Gerrard & Co., Des Plaines, Illinois, Independent Metal Strap Co., Inc., Roslyn, N.Y. or approved equal.

D. Mount nameplates in a manner specifically approved by the Engineer after the installation of equipment or construction of structures. Submit details of the method of fastening to the Engineer for approval. Provide fastening devices for nameplates and valves of stainless steel construction.

E. Mount valve identification signs with approved stainless steel brackets or approved stainless steel strapping in such a fashion that sharp corners or edges on signs, brackets, bolts, chain or strapping will not constitute a hazard to personnel operating the valves. Since it is impractical to detail each means of attachment in the Specifications or on the Contract Drawings, each means of attachment will receive approval only on its own merits. Submit for approval sketches of each type proposed.

F. Do not attach identification tags or signs to handwheels. Use of flange bolts or bonnet bolts as a means of attachment of brackets will receive consideration. Provide all attachment devices and bolting of Type 316 stainless steel.

END OF SECTION

SECTION 33 10 00
VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish, install, paint, adjust, and test all valves shown on the Drawings or required to provide a complete installation which is ready to operate. Valves shall be installed complete with all necessary appurtenances including hangers and supports, extension stems, floorstands, hand and chain wheels, operating wrenches, indicators or special automatic operators.

1.02 MATERIALS AND WORKMANSHIP

A. Valves and appurtenances for chemical feed systems shall be as specified elsewhere in these Specifications.

B. Gate valves shall conform with all applicable provisions of A.W.W.A. Standard Specification C-500, or C-509, latest edition. Butterfly valves shall conform with all applicable provisions of A.W.W.A. Standard Specification C504, latest edition. Plug valves and knife valves shall be the best of their respective types and shall conform to the criteria listed in these Specifications.

C. Gate valves and check valves shall be of the same manufacturer, as far as practical.

D. All valves of a particular type shall be of the same manufacturer.

E. Valve flanges shall be ANSI 125 lb. Bells for underground valves shall match adjoining piping. No knife valve may be used for underground installation.

F. Valves smaller than three (3") inches shall have threaded ends. Buried valves shall have standard two (2") inch operating nuts and shall have mechanical joint ends to conform to connecting piping.

G. Extension stems shall be provided for all buried valves where the operating nut is greater than three (3') feet below finished grade. Operating nuts or extension stems shall be brought to within 6" of the finished grade. Centering collars are to be provided on all extension stems. Extension stems shall be mechanically secured to the valve stem/nut using stainless steel hardware.

H. All flanged valves shall have laying lengths conforming to American National Standard dimensions for cast iron flanged valves, ANSI B16.10.

I. Valves shall open by turning hand wheels or operating nuts to the left, counterclockwise.

J. Non-rising stem gate valves shall be provided with "O" ring type packing.

K. Rising stem gate valves shall be provided with packed boxes.

L. Operations of valves shall be design so that the effort required to operate the handwheel, level, tee wrench, or chain shall not exceed 40 pounds applied at the extremity of the wheel, tee wrench, or lever.

1.03 DATA TO BE SUBMITTED

A. The Contractor shall submit for approval, full data on all valves to be furnished, including dimension drawings showing details of construction and complete materials specifications.

1.04 GUARANTEE

A. All valves, specialties and appurtenances shall be guaranteed as to design, materials, and workmanship for a period of one (1) year from date of final acceptance.

PART 2 – PRODUCTS

2.01 CAST IRON BUTTERFLY VALVES

A. All butterfly valves shall conform with AWWA C-504.

B. Valve bodies shall be constructed of cast iron ASTM A126, Class B. Valve shafts shall be of wrought stainless steel with low friction journals. Valve discs shall be constructed of cast or ductile iron ASTM A-126, A-48, A-536. Valve seats shall be of synthetic rubber, rated for the expected temperature range of 60-170ºF. The seats shall be secured to the valve body or the valve disc as is standard for the manufacturers specified. Seat bond shall withstand 75 pounds pull under test procedure ASTM D-429, Method B. Bearings shall be sleeve-type, corrosion resistant and self-lubricating. Packing shall be self-adjusting Chevron type. Painting shall be standard.

C. All valves up to 20-inch size shall be of Class 150B. Pressure rating of larger valves shall be rated for 150 psi pressure.

D. Exposed valves shall have end flanges conforming in dimensions and drilling to ANSI B16.1, Class 125. Buried valves shall have mechanical joints conforming to the requirements of ANSI A21.11

E. Lever operated valves shall have heavy steel hand levers, provided with a comfortable non-metallic hand grip. It shall be possible to lock the lever to any desired position along its travel. Lever lengths shall be 12-inch for valves through 6-inch size. Lever operators shall not be used for any valve larger than 6-inch size.

F. Where specified, called for on the Contract Drawings, shown in a location subject to submergence or buried, valves and operators shall be suitable for submerged service.

G. Buried valves shall be provided with valve disc position indicator units. Each unit shall consist of cast iron adaptor for the valve box, guide bushing, position indicator, flexible washer, and a two-inch square AWWA nut with set screw. Exterior buried valves shall be adequately restrained by the same restraining method employed for the piping system.

H. Where specified or shown on the Drawings, valves shall be furnished with standard weight, 3 piece, cast iron valve boxes. Boxes shall be of the screw type, with deep covers to prevent tipping, and shall be suitably marked. Sections shall not be less than 5-1/4 inches in diameter. Lengths shall be suitable for use in the location indicated. On some buried valves, the depth of cover may not be deep enough to take the standard type of valve box. In such a case, a cast iron box of a design suitable for the particular conditions shall be furnished and installed. Such design shall provide for the elimination of direct loads through the box to the valve.

I. Exposed valves shall be model BAW as manufactured by DeZurik Industries, or equal.

J. Buried valves shall be Pratt Groundhog, as manufactured by Henry Pratt Co., or equal.

2.02 TAPPING SLEEVES AND VALVES

A. Tapping sleeves and valves shall be as manufactured by the U.S. Pipe and Foundry, Valve and Hydrant division, or equal and shall employ an 0-ring, rubber gland type saddle.

B. Valves and valve boxes shall comply with the pertinent provisions listed in these Specifications, with the exception that tapping valves shall be provided with flanged inlet; mechanical joint outlet ends.

C. Work shall be carried out by personnel thoroughly experienced in the construction of wet taps, using approved methods and equipment. Certain construction methods are to be approved by the Engineer prior to any work being performed. The tapping sleeves and valves shall be securely supported and blocked by poured Class 1500 psi concrete against undisturbed ground.

2.03 SOLENOID VALVES

A. Solenoid valves shall be bronze body, packless, full port area, globe type, with renewable composition disc seats. Valves shall be suitable for operation on 120V, 1 Ph, 60 Hz current and shall conform to the requirements of the Instrumentation Specification and shall be as manufactured by Automatic Switch Company, Gould "Vevetrol," or equal.

2.04 BACKFLOW PREVENTERS

A. Backflow preventer units of the reduced pressure type shall be furnished and installed on water lines where shown on the Contract Drawings. Each backflow preventer unit shall be a complete assembly consisting of two spring loaded check valves with a protection zone in between the check valves. This zone shall be controlled by diaphragm operated differential pressure relief valve. Low zone pressure shall open the differential valve to dissipate any water which might flow in a reverse direction through the downstream check. Test cocks shall be installed at each end of each check valve. Each unit shall be furnished complete with non-rising stem AWWA type gate valves at each end of the unit. Unit shall have 125 pound ANSI flanged ends and shall have a pressure rating of 150 psi. Body and working parts shall be bronze, brass and bronze trim. Provide drain line to floor drain.

B. Springs shall be stainless steel or plastic coated carbon steel. Backflow preventers shall be Wilkins Model 975XL (sizes ¾” to 2”) and Wilkins Model 375ADA (for sizes 2 ½” to 10”) as manufactured by Zurn Industries, Watts Model #909QT-S (sizes ¾” to 2”), Hersey/Beer Model 6C, or equal. The units shall meet all codes, Pennsylvania Department of Environmental Protection (MDE) requirements, and the local Water Company's approval.

2.05 MISCELLANEOUS SMALL VALVES AND SPECIALTY ITEMS

A. The Contractor shall furnish and install miscellaneous small valves where shown on the Drawings or mentioned in the Specifications.

B. The Contractor is advised that the general schedule appearing below may not contain each and every valve or specialty item required for all the various services and conditions encountered on this project. The schedule is intended to guide the Contractor as to the most probable types of small valves or specialties which would be needed to complete his work. The Contractor shall work with the Engineer in order to evaluate the requirements on a case by case basis.

C. All valves 2-1/2 inches and smaller shall have bronze bodies and threaded ends unless otherwise noted. They shall be designed for 150 psi service pressure.

D. All valves and specialty valves shall be as manufactured by Walworth, DeZurik, Crane, Flowserve Anchor-Darling, Asco, Apco, Mueller, Clow or equal. They shall be furnished and installed as required to fulfill the intent of the Drawing and Specifications.

E. Insofar as practicable, valves and specialty items shall be furnished and installed for usage according to the following Schedule:

Type	**Manufacturer and/or Model Number, or Equal**	**General Usage**
Plug Valves	DeZurik	Individual air supplies
Gate Valves	Crane Model 429	Shut-off (non-throttling)
Globe Valves	Crane Model 7TF	Shut-off (throttling)
Needle Valves	Crane Figure 88	Fine Adjustment
Check Valves	Crane Model 27TF	Back Flow Prevention
Knife Gate Valves	De Zurik	Scum and grease
Solenoid Valves	ASCO as req'd	Automatic Control

Pressure Reducing Valves		
Pressure Regulating Pressure Reduction Valves	Watts 25AUB	Regulation W/Strainer
Safety Relief Valves	McDonnell & Miller	Over Pressure Safety
Air Release Valves	APCO Series 143C	Release of Air
Interior Hose Bibbs	NIBCO Bronze Gate Valves	Air and Water Service, Furnish Each Valve with an Adapter to a Fit Universal Quick Hose Coupling
1-1/2" Flushing	DeZurik	Connections
Universal Quick Acting Couplings	Camlock Type 633	Flushing Connections
Float Valves	Watts Model	Seal Water Tank Level
Flow Indicators	Malema M-10000-32034-02.	Flow Indication
Curb Valve/Stop	Mueller	
PVC Pressure Relief	Plast-O-Matic	Valve Series RVT
Shear Gates Shut-off	M&H Fig. No. 44-02	
Pump Flap Valves	M&H Fig. No. 47-02	
Shut-off (gravity)		
Mud Valves Shut-off	M&H Fig. No. 140-02	

F. Heavy steel extension stems with adjustable cast iron couplings and bronze-bushed adjustable supports shall be provided and installed by the Contractor where required for convenient operation of valves. Extension stems shall be stainless steel where stems are subject to submergence or on buried valve applications. Extension stems shall be mechanically attached to the valve stem/nut using stainless steel hardware. Floor boxes, cast in the concrete, shall be furnished where required and shall be of the bushing type.

G. Chain wheels shall be provided where shown on the Drawings or as specified, and shall be provided with deep flanges and teeth; chain guides; and the proper length of rustproof chain.

H. Floor stands, bench stands shall be provided with suitable structural supports or be mounted on concrete structures. They shall not be supported from gratings.

PART 3 - EXECUTION

3.01 INSTALLATION PROCEDURES

A. Valves shall be set plumb, and where required, shall be securely supported or hung. Valves shall be packed and adjusted prior to field tests and shall be left in good operating condition. Valves shall be painted to conform to adjoining piping. Valve boxes shall be positioned directly over the valves. After being correctly positioned for line and grade, the earth fill shall be carefully tamped around the valve box. The top of the box shall be set flush with pavement surfaces in paved areas and shall be one (1") inch above ground in grassed or earth areas. Valve boxes on buried valves shall be cleaned out; boxes shall be centered on operating nuts to permit free movement of valve keys.

B. Valve boxes shall be color-code painted in accordance with another division of these Specifications.

3.02 VALVE TAGS

A. The Contractor shall furnish and install on every exposed valve a 1-1/2” square red plastic identification tag 3/32” thick with white incised numbers, accompanied by a heavy brass “S” hook, as manufactured by Seton Plate Company, Style 2960, or equivalent. Numbers shall correspond to those listed in the Valve Schedule. Where valve operators are not located at the valve itself, two tags shall be provided; one at the valve and the other at the point of operation. Tags shall not be attached to the valve operators or other moving parts.

END OF SECTION

SECTION 33 10 60
PLASTIC PIPING SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section includes rigid piping, flexible tubing, valves, and accessories for piping systems carrying liquid chemicals or chemical solutions for (12.5%) sodium hypochlorite.

1.02 RELATED WORK

A. Section 11 00 50 – Basic Equipment Materials and Methods
B. Section 11 24 10 – Polyethylene Chemical Storage Tanks
C. Section 11 24 40 – Chemical Metering and Transfer Pumps

1.03 SUBMITTALS

A. The Contractor shall submit the materials for each component along with data sheets demonstrating chemical compatibility.

B. Prior to installing any equipment or piping, the Contractor shall prepare dimensioned layout drawings, indicating the proposed horizontal and vertical arrangement of all chemical feed piping. The Contractor shall submit these drawings to the Engineer for approval, along with manufacturers' certifications that the proposed products are compatible with the service conditions.

1.04 DELIVERY, STORAGE, AND HANDLING OF PLASTIC PIPE

A. The Contractor is cautioned to exercise care in handling, loading, unloading, and storing CPVC and PVC pipe and fittings. All CPVC and PVC pipe and fittings shall be stored under cover before use, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subject to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded and said section of pipe shall be cut out and rejoined with a suitable coupling.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials that come in contact with the chemicals being handled must be resistant to attack from those chemicals. In the case of piping or valves available with alternate

or optional materials, only those materials carrying the manufacturer's highest rating for the application shall be used

B. Pipe, Tubing, and Fittings

1. Polyvinyl Chloride (PVC) Pipe and Fittings

a. All PVC pipe and fittings shall bear the approval seal of the National Sanitation Foundation (NSF). Plastic pipe shall be unplasticized normal-impact polyvinyl chloride (PVC) Schedule 80 Pipe, conforming to ASTM Standard D1785, Type I. Fittings shall be of the same material and strength, shall be of the molded socket bell and spigot, conforming to ASTM Standard D2467, and shall be joined to the pipe with approved solvent or fittings can be of the flanged design. No threaded couplings or fittings shall be used. Flanges shall be drilled to 125 lb. ANSI B16.1 standard pattern. Solvent cement jointing shall conform to ASTM D2855, "Standard Recommended Practice for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings", and the manufacturer's recommendations. Heavy-Body cement per ASTM D-2564 and primer per ASTM F-656 shall be used. Hardware and gasket material for all flanged connections shall be in accordance with the piping schedule in Section 3.03 of this section.

2. Flexible Tubing

a. Tubing is called out on drawings in internal diameters. Tubing shall have a minimum pressure rating of 125 psi at 70°F for 1" diameter and smaller. Flexible tubing shall be transparent fluoropolymer tubing (FEP) except where otherwise indicated. Piping shall be manufactured of materials approved by the NSF. Runs through sleeves shall be continuous, with no inaccessible couplings or fittings. Fittings shall be barbed with two stainless steel worm-gear clamps per tube end.

1) Flexible tubing for sodium hypochlorite where indicated on the Drawings, shall be Versilon FTP tubing, as manufactured by Saint-Gobain Performance Plastics, Mickleton, NJ, or approved equal.
2) Flexible tubing for polymer shall be linear high-density polyethylene (HDPE).

C. True Union Ball Valves

1. Ball valves for sodium hypochlorite service shall be TBZ Series True Union Vented Ball Valves by Hayward Industries, Inc. Ball Valves for all other chemicals shall be TB Series True Union Ball Valves by Hayward Industries, Inc.

a. Valve shall have socket/threaded connections and full port design.
b. Ball valves shall be rated for a design pressure of 250 psi @ 70° F.
c. Ball valves shall be installed with a vent such that the vent is directed back upstream.
d. Valves shall be NSF 61 listed.
e. Valves shall include Double O-Ring stem seals of materials listed in Section 3.03.
f. Valve seats shall be PTFE.
g. Valve material shall match Pipe Material provided in Section 3.03.
h. Valves shall be provided with electric actuators where indicated on the drawings. Electric actuators for valves 2" and smaller shall be for 90 degree on/off service, Model EAU29 manufactured by Hayward Flow Control.

D. Check Valves

1. Check valves shall TC series true union check valves by Hayward Industries, Inc., or approved equal.
2. Check valves shall match the materials listed in Section 3.03.
3. Check valves shall be rated for a design pressure of 150 psi @ 70°F.

E. Duckbill Check Valves

1. Duckbill elastomeric check valves shall be of the Series TF-2 as manufactured by Tideflex Technologies or approved equal.

2. Duckbill check valves are to be all rubber and the flow operated check type with an integral slip-on end connection. The port area shall contour down to a duckbill which shall allow passage of flow in one direction while preventing reverse flow. The flexible duckbill sleeve shall be one-piece rubber construction with nylon reinforcement. The bill portion shall be thinner and more flexible than the valve body and formed into a curve of 180°.

3. Acceptable materials of construction for duckbill check valves must be compatible with sodium hypochlorite: EPDM, Butyl, Hypalon, or Viton, with 316 SS mounting band.

F. Quick Couplings

1. Couplings for the chemical fill lines shall be of the cam and groove type
2. consisting of a male adapter. Male adapters shall be designed to receive a female coupler without requiring threading, bolting or tools. Connections shall remain tight and leakproof under pressures up to 100 psig. Each adapter shall be furnished with a dust cap complete with a 18-inch long stainless steel security chain. Couplings shall be constructed of 316L stainless steel material

except those used for sodium hypochlorite. Couplings for sodium hypochlorite shall be polypropylene. Couplings shall be as manufactured by Dover Corp., OPW Division, Andrews, Evertite or approved equal.

G. Strainers

1. Y-strainers shall be as manufactured by Hayward Industrial Products, Inc, or approved equal.
2. All strainer cleanout caps shall have an integrally molded hex nut for easy removal.
3. Y-strainers shall match the materials listed in Section 3.03.

H. Backpressure Valves

1. Backpressure valves shall be Griffco Valve Inc., M-series for 1/4 and 1/2 inch diameter and G-Series for 3/4 inch through 4-inch diameter, or approved equal.
2. Valves shall have a maximum operating pressure of 375 psi at 70°F.
3. Valves shall have a PTFE coated elastomer diaphragm.
4. Backpressure valves for all chemical feed systems shall match the materials listed in Section 3.03 with standard threaded ends.

I. Pressure Relief Valves

1. Pressure relief valves shall be Griffco Valve Inc., 2-port G-series with threaded ends, or approved equal.
2. Pressure relief valves shall be field set for 15 psi above backpressure valve final setting.
3. No isolation valves shall be installed between the chemical feed pump discharge and the pressure relief valve.
4. Pressure relief valves for all chemical feed systems shall match the materials listed in Section 3.03.
5. Valves shall have a maximum operating pressure of 375 psi @ 70°F. Valves shall have a PTFE coated elastomer diaphragm.

J. Pulsation Dampeners

1. Pulsation dampeners for the metering pumps shall be Griffco pulsation dampeners. Sizing shall result in no more than plus or minus 5% variation in average pressure in the discharge line. System supplier shall provide sizing calculation with the submittal.

K. Main Connections with Injection Quill

1. Main connections with retractable injectors shall be as manufactured by Saf-T- Flo, or equal.

2. Materials shall be compatible with the chemical being used.
3. Pipe connection shall be designed to withstand the maximum water main pressure.
4. The solution tube shall be sized to match the pump discharge line and be provided with a suitable locking device to prevent accidental release of the solution tube from the water main while under pressure.
5. Main connections shall be provided with a ball check valve to prevent backpressure from the main from entering the chemical feed system.

L. Calibration Columns

1. Calibration columns shall be of PVC construction with a threaded vent connection. Calibration columns shall be sized to allow a 30-second draw down test with the pump operating at maximum capacity requirements per each chemical feed service. Columns shall be manufactured Griffco, or approved equal.

M. Double Containment Piping System

1. Provide double containment for all sodium hypochlorite piping outside of the chlorine room containment area. Double containment shall be provided with manual leak detection valves at low points.
2. All materials, fittings, joints, and appurtenances shall be fully compatible and corrosion resistant to 15% sodium hypochlorite.
3. The double containment piping system shall be Tygon 2375 chemical transfer tubing primary piping system supported within a Schedule 80 PVC secondary containment housing. Tubing shall be Non-DEHP and plasticizer free.
4. Each system shall be provided with suitable drains and vents and be designed to provide complete drainage of both the primary and secondary containment piping. Interstitial supporting devices shall be provided within the secondary containment pipe and shall be designed to allow continuous drainage in the annular space to the drain points. Drain fittings shall be designed to allow a valve attachment to be made so that the secondary containment compartment may be readily drained and manually checked for leaks.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, locations, etc., which may be required.

B. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and arrange his/her work accordingly, furnishing all

materials necessary, to meet these conditions.

C. Piping shall be pitched to drain.

D. All piping adaptors, flanges, reducers and related appurtenances required to match equipment nozzles or other component connections shall be furnished and installed as required for equipment or piping furnished and installed under this Contract.

E. Provisions shall be made for equipment removal for repair, servicing or replacement by utilization of couplings and flanges. Instrument connections in piping systems may be screwed to match the instrument connections. All elements in a particular system shall be compatible with the specification applicable to that system.

F. Burrs shall be removed from mating threads before assembly. Where specifically permitted, threaded joints shall be made up with Teflon joint sealing tape, Minnesota Mining and Manufacturing Company, No. 547, as supplied by Minnesota Mining and Manufacturing Company, by crane Packing Company (Thread Tape), or by Permacell, Inc. (Ribbon Dope). Joint sealing tape shall be applied to the current requirements specified in ANSI Standard No. B2.1. Screwed connections will be permitted in plastic piping systems only where they are required to connect to equipment, specifications or instruments having only standard threaded connections. All nipples shall be factory cut of the same materials as the pipe. No close or butt nipples shall be used. The ends of all pipe and nipples shall be reamed to remove any projections extending into the normal interior diameter of the pipe or nipples.

G. Unions shall be used for connections two (2) inches and smaller to the extent indicated on the Drawings, specified or ordered for making connections to specialties, valves, equipment or apparatus not having flanged connections. Materials shall be as specified and as required to suit service conditions. Unions in plastic piping shall be of the socket weld type.

H. Chemical feed system piping and valves shall be supported by non-metallic pipe supports as specified in Section 15124 of these Specifications.

3.02 TESTING

A. No testing shall be done until the last solvent cemented joint made has had 24 hours to set and cure.

B. All CPVC and PVC piping on the discharge side of pumps shall be tested at 1.5 times normal working pressure for a period of 2 hours and proven tight. If leaks occur, the joint or joints shall be replaced and these tests repeated.

3.03 PIPING SCHEDULE

Service	Pipe Color Code (1)	Pipe Material (2)	Fittings	Joint Type (3)	Gasket Material	Hardware
Sodium Hypochlorite (15%)	Yellow	PVC Schedule 80	PVC Schedule 80	Socket Weld	Viton	Hastelloy-C

1. In situations where two colors do not have sufficient contract to easily differentiate between them, a 6-inch band of contrasting color should be painted on one of the pipes at approximately 30-inch intervals.
2. FEP tubing shall be used in lieu of PVC Schedule 80 piping as indicated on the contract drawings.
3. Socket welds shall be used in all cases except when FEP tubing is used as indicated on the Contract Drawings.
4. The name of the liquid or gas, with arrows indicating the direction of flow, also should be painted on the pipe.

END OF SECTION

City of Rockville
Rockville, Maryland

BID PROPOSAL FORMS

INVITATION FOR BID # 11-23
CONSTRUCTION OF A BULK
SODIUM HYPOCHLORITE SYSTEM

THESE FORMS, UNLESS NOTED OTHERWISE, MUST BE COMPLETED, SIGNED AND SUBMITTED

FAILURE TO COMPLY WILL RESULT IN THE DISQUALIFICATION OF YOUR BID

In response to the advertisement by the City of Rockville inviting bids for the work and in conformance with the bid document on file in the Purchasing Division of the City of Rockville, we hereby certify that we are the only person, or persons interested in this bid proposal as principals, and that an examination has been made of the work site, the specifications, the plans and the bid documents. We propose to furnish all necessary machinery, materials, equipment, tools, labor and other means of construction required to complete the project. Bidders must bid all items.

The following items shall be performed per the referenced Standard Specification and the Contract Documents. Measurement and Payment shall be as described in the Technical Specifications unless otherwise specified in the Contract Documents. All work items described in the Contract Documents that are not referenced by a specific pay item shall be considered incidental to all other items in the Contract Documents.

City of Rockville
Rockville, Maryland

INVITATION FOR BID # 11-23

CONSTRUCTION OF A BULK SODIUM HYPOCHLORITE SYSTEM BID PROPOSAL FORM

THIS FORM MUST BE COMPLETED, SIGNED AND RETURNED

IN ACCORDANCE WITH ALL TERMS, SPECIFICATIONS AND REQUIREMENTS, WE PROPOSE TO FURNISH ALL LABOR, EQUIPMENT, MATERIALS AND SERVICES AND THE PERFORMANCE OF ALL WORK NECESSARY FOR THE PROJECT. PROVIDE PRICING BELOW TO INCLUDE OVERHEAD, PROFIT, TAXES, INSURANCE AND OTHER APPLICABLE FEES AND COSTS. ALTERATIONS TO THIS FORM OR BID ALTERNATES (UNLESS OTHERWISE SPECIFIED) ARE NOT ACCEPTABLE. LINE ITEMS LEFT BLANK OR MARKED "$0" MAY DEEM THIS BID NON-RESPONSIVE.

ITEM NO.	DESCRIPTION	UNIT	EST QTY	UNIT PRICE	TOTAL
1001	Mobilization	LS	1		
1002	Temporary Chlorination System	LS	1		
1003	Sitework & Demolition	LS	1		
1004	STRUCTURAL AND ARCHITECTURAL SITE WORK				
1004.1	Concrete and Containment Wall Work	LS	1		
1004.2	South and West Wall Work	LS	1		
1004.3	Painting and Floor Coating Work	LS	1		

ITEM NO.	DESCRIPTION	UNIT	EST QTY	UNIT PRICE	TOTAL
1004.4	Outdoor Storage Access Ramp	LS			
1005	PROCESS MECHANICAL SITE WORK				
1005.1	Chemical Feed System Storage Tanks	LS			
1005.2	Transfer Pump System	LS			
1005.3	Metering Pump System	LS			
1005.4	Sodium Hypochlorite Fill Station	LS			
1005.5	Chlorine Feed Lines	LS			
1006	HVAC & PLUMBING SITE WORK				
1006.1	Fire Sprinkler System	LS			
1006.2	Sump Pump System	LS			
1006.3	Miscellaneous Piping and Accessories and Plumbing Work	LS			
1006.4	HVAC System	LS			
1006.5	HVAC System Testing and Balancing	LS			

ITEM NO.	DESCRIPTION	UNIT	EST QTY	UNIT PRICE	TOTAL
1007	ELECTRICAL SITE WORK				
1007.1	Lighting and Receptacles	LS	1		
1007.2	Conduits and Conductors	LS	1		
1007.3	Instrumentation	LS	1		
1007.4	Control Panels and Integration	LS	1		
A. BASE BID - TOTAL					
4001	Allowance: Hazardous Materials Abatement (If needed)	LS	1		$50,000
B. ALLOWANCE: HAZARDOUS MATERIALS ABATEMENT - TOTAL					$50,000
5001	Contingency: Silo #3 Demolition and Floor Restoration	LS	1		
C. CONTINGENCY: SILO #3 DEMOLITION AND FLOOR RESTORATION - TOTAL					

TOTAL BID PRICE:

A. Base Bid – Total	
B. Allowance: Hazardous Materials Abatement – Total	$50,000
C. Contingency: Silo #3 Demolition and Floor Restoration – Total	
Total BID (Sum A + B + C)	

Write the Total Bid Price for the **IFB 11-23 Rockville Water Treatment Plant Improvements: Bulk Sodium Hypochlorite System** in words:

_____

Pay Item Descriptions:

ITEM NO.	Item	Description
1001	Mobilization	Onsite mobilization and preconstruction planning.
1002	Temporary Chlorination System	Temporary chlorination system required for full duration of construction until new system has been approved for use. Includes delivery of equipment and housing enclosure to site, temporary controls, installation, field testing, and operation.
1003	Sitework and Demolition	Plant and site related demolition and upgrades work including hoist salvage.
1004	STRUCTURAL AND ARCHITECTURAL SITE WORK	
1004.1	Concrete and Containment Wall Work	Outdoor slab, secondary containment wall with metal crossover ladder, tank and equipment pads, foundation sump, and miscellaneous patching/restoration per Drawings and Specifications
1004.2	South and West Wall Work	South and West CMU walls and reinforcing, steel channel and plate for lintel, and accessories, FRP door, louver, sealant, frame and hardware, and installation and testing per Drawings and Specifications
1004.3	Painting and Floor Coating Work, Misc. Signage	Painting of CMU exterior walls and chlorine room interior walls, chlorine room interior floor epoxy coating and miscellaneous signage per Drawings and Specifications
1004.4	Outdoor Storage Access Ramp	Concrete ramp, stone subgrade, grading and restoration.
1005	PROCESS MECHANICAL SITE WORK	
1005.1	Chemical Feed System Storage Tanks	Bulk storage tanks, Day tank, quick-connect fill connections and outdoor enclosure, tank vent piping and pipe supports, installation, testing per
1005.2	Transfer Pump System	Transfer pump system, discharge and suction valves, ancillary piping, supports and appurtenances, installation, testing per Drawings and Specifications

1005.3	Metering Pump System	Metering pump system with calibration column, discharge and suction valves, ancillary piping, supports and appurtenances, installation, testing per Drawings and
1005.4	Sodium Hypochlorite Fill Station	Unloading Station Control Panel, installation, testing per Drawings and Specifications
1005.5	Chlorine Feed Lines	Chlorine feed line, pipe hangar and supports, valves, retractable injection quills, freeze protection, backfill, installation and testing per Drawings and Specifications
1006	HVAC & PLUMBING SITE WORK	
1006.1	Fire Sprinkler System	Chemical Building fire sprinkler system for first and second floor, PW connection, installation and testing per Drawings and Specifications
1006.2	Sump Pump System	Sump pump system, discharge quick- connect fitting, grating, valves, piping and piping supports to all discharge locations, installation, testing per Drawings and Specifications
1006.3	Miscellaneous Piping and Accessories and Plumbing Work	Chemical feed system PW flushing line with backflow preventor, existing chlorine room drain caps, emergency eyewash and shower, additional plumbing and piping installation and testing per Drawings and Specifications
1006.4	HVAC System	Supply and exhaust fans, AC cooling unit, ductwork, electric unit heaters, HVAC controls, cables, conduits, fittings, supports, testing and installation per Drawings and Specifications
1006.5	HVAC System Testing and Balancing	HVAC system testing and balancing per Drawings and Specifications
1007	ELECTRICAL SITE WORK	
1007.1	Lighting and Receptacles	Lighting, receptacles and electrical appurtenances for the Hypochlorite Room, installation and testing, per Drawings and Specifications
1007.2	Conduits and Conductors	Conduits and conductors, installation and testing, per Drawings and Specifications

1007.3	Instrumentation	Supply, installation and testing of Instrumentation per Drawings and Specifications
1007.4	Control Panels and Integration	Control panels and SCADA integration for equipment per Drawings and Specifications
4001	Allowance: Hazardous Materials Abatement, if needed	Hazardous abatement by a Maryland Asbestos Licensed Contractor including permitting, cleanup and disposal as applicable for plant and site related demolition and upgrades work.
5001	Contingency: Silo #3 Demolition and Floor Restoration	Demolition and disposal of Silo #3 including concrete pad, materials conduit, feeder chute, hopper and bin, and all associated appurtenances. Submittal for concrete floor restoration and fill for first and second floor signed and sealed by a Professional Engineer licensed in the State of Maryland.

By submitting this offer I acknowledge receipt of and incorporation into this offer of the following Addenda (check each applicable box):

Addendum #1 ☐ , Addendum #2 ☐, Addendum #3 ☐, Addendum #4 ☐ , Addendum #5 ☐, Addendum #6 ☐

CONTRACT DURATION

This project is tentatively scheduled for Mayor and Council award in August/September 2023 and the City plans on issuing the purchase order and notice to proceed within 15 working days after Mayor and Council award. All work associated with this project must be completed within 270 calendar days of the date of issuance of the notice to proceed. Time is of the essence.

Confirm your ability to meet the above schedule _____ YES _____ NO

This bid and its firm fixed prices shall remain valid for 180 days after bid opening, for acceptance by the City.

The City of Rockville reserves the right to reject any or all bids, offer or proposals, to waive informalities, and to accept all or any part of any bid, offer proposal as they may deem to be in the best interest of the City of Rockville.

I hereby certify that I have read and understand the requirements of this Invitation for Bid No. 11-23 and, that I, as the Bidder, will comply with all requirements, and that I am duly authorized to execute this proposal/offer document and any contract(s) and/or other transactions required by award of this Invitation For Bid (IFB).

Comprehensive Signature Page

THIS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL

Complete under appropriate section & return with your bid.

Instruction for Signature on Bid Proposal

The bid, if submitted by an individual, shall be signed by an individual; if submitted by a partnership, shall be signed by such member or members of the partnership as have authority to bind the partnership; if submitted by a corporation the same shall be signed by the President and attested by the Secretary or an Assistant Secretary. If not signed by the President as aforesaid, there must be attached a copy of that portion of the By-Laws, or a copy of a Board resolution, duly certified by the Secretary, showing the authority of the person so signing on behalf of the corporation. In lieu thereof, the corporation may file such evidence with the Administration, duly certified by the Secretary, together with a list of the names of those officers having authority to execute documents on behalf of the corporation, duly certified by the Secretary, which listing shall remain in full force and effect until such time as the Administration is advised in writing to the contrary. In any case where a bid is signed by an Attorney in Fact the same must be accompanied by a copy of the appointing document, duly certified.

IF AN INDIVIDUAL					
Individual Name					
DBA					
Address					
City		State		ZIP	
Signature					
Printed Name					
Title					
Date					
Witness Signature					

Witness Name	
Witness Title	
Date	

IF A PARTNERSHIP					
Name of Partnership					
Address					
City		State		ZIP	
Member Signature					
Printed Name					
Title					
Date					
Witness Signature					
Witness Name					
Witness Title					
Date					

IF A CORPORATION					
Name of Corporation					
Address					
City		State		ZIP	
Fed ID or SSN					
State Of Incorporation					
Signature					
Printed Name					
Title					
Date					
Witness Signature					
Witness Name					
Witness Title					
Date					

CONTACT FOR ADMINISTRATION	
Individual Name	
e-mail	
Telephone	
FAX	
EMERGENCY SERVICE (24hr.) PHONE	

REMITTANCE ADDRESS (if different than organizational address above)					
Address					
City		State		ZIP+4	

MFD-V INFORMATION	
MFD-V Information	***For informational purposes only*** *– Is your company certified as a Minority, Female, Disabled or Veteran (MFD-V) business: _____ yes _____ no _____ I choose not to respond*

AFFIDAVIT OF QUALIFICATION TO CONTRACT WITH A PUBLIC BODY

THIS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL

I hereby affirm that: I am the _____ (insert title) and the duly authorized representative of _____ (insert organization name) whose address is _____

And, that I possess the legal authority to make this affidavit on behalf of myself and the firm for which I am acting.

I affirm:

1. Except as described in Paragraph 2 below, neither I nor the above firm nor, to the best of my knowledge, any of its controlling stockholders, officers, directors, or partners, performing contracts with any public body (the State or any unit thereof, or any local governmental entity in the state, including any bi-county or multi-county entity), has:

A. been convicted under the laws of the State of Maryland, any other state, or the United States of any of the following:
(1) bribery, attempted bribery, or conspiracy to bribe.
(2) a criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract.
(3) fraud, embezzlement, theft, forgery, falsification or destruction of records, or receiving stolen property.
(4) a criminal violation of an anti-trust statute.
(5) a violation of the Racketeer Influenced and Corrupt Organization act, or the Mail Fraud Act, for acts in connection with the submission of bids or proposals for a public or private contract.
(6) a violation of Section 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland.
(7) conspiracy to commit any of the foregoing.

B. pled *nolo contendere* to, or received probation before verdict for, a charge of any offense set forth in subsection A of this paragraph.

C. been found civilly liable under an anti-trust statute of the State of Maryland, another state, or the United States for acts or omissions in connection with the submission of bids or proposals for a public or private contract.

D. during the course of an official investigation or other proceeding, admitted, in writing or under oath, an act or omission that would constitute grounds for conviction or liability under any law or statute described in subsection A or C of this paragraph.

2. [State "none," or as appropriate, list any conviction, plea or admission as described in Paragraph 1 above, with the date, court, official or administrative body, the individuals involved and their position with the firm, and the sentence or disposition, if any]._____

3. I further affirm that neither I nor the above firm shall knowingly enter into a contract with the Mayor and Council of Rockville under which a person or business debarred or suspended from contracting with a public body under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland, will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

I acknowledge that this Affidavit shall be furnished to the Mayor and Council of Rockville and, where appropriate, to the State Board of Public Works and to the Attorney General. I acknowledge that I am executing this Affidavit in compliance with the provisions of Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland which provides that persons who have engaged in certain prohibited activity may be disqualified, either by operation in law or after a hearing, from entering into contracts with the Mayor and Council of Rockville. I further acknowledge that if the representations set forth in this Affidavit are not true and correct, the Mayor and Council of Rockville may terminate any contract awarded, and take any other appropriate action.

Signature _____

Printed Name _____

Title _____

Date _____

NON—COLLUSION AFFIDAVIT
THIS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL

I hereby affirm that: I am the _____ (insert title) and the duly authorized representative of _____ (insert organization name) whose address is _____
And, that I possess the legal authority to make this affidavit on behalf of myself and the firm for which I am acting.
I affirm:

1. I am fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such bid;

2. Such bid is genuine and is not a collusive or sham bid

3. Neither the said bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other bidder, firm or person to submit a collusive or sham bid in connection with the Contract for which the attached bid has been submitted or to refrain from bidding in connection with Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other bidder, firm or person to fix the price or prices in the attached bid or of any other bidder, or to fix any overhead, profit or cost element of the bid price or the bid price of any other bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Mayor and Council of Rockville, Maryland (Local Public Agency) or any person interested in the proposed Contract; and

4. The price or prices quoted in the attached bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant. I do solemnly declare and affirm under the penalties of perjury that the contents of these affidavits are true and correct.

Signature
Printed Name
Title
Date

BIDDER'S QUESTIONNAIRE

CITY MAY REQUIRE COMPLETION AND SUBMISSION AFTER RECEIPT OF BIDS

In order to be considered for award, the Bidder must complete this questionnaire in its entirety and submit it to the Purchasing Manager within the time specified. The bidder must answer all questions. If additional space is required, attach continuation sheets and clearly indicate the question being answered. The City reserves the right to verify any information contained within this report and to request additional information or clarification. The City reserves the right to reject the bid of a bidder who has previously failed to perform properly or to complete in a timely manner contracts of a similar nature, or if investigation shows the bidder unable to perform the requirements of the Contract or if the bidder fails to complete and submit the Bidder's Questionnaire in its entirety. If additional sheets are necessary please attach to this form and reference the applicable number.

Bidder's Name			
Bidder's Address			
City		State / Zip	
Telephone		Fax Number	
Organized under the laws of State of:			
BIDDER'S AUTHORIZED REPRESENTATIVE'S SIGNATURE BELOW		DATE	
Print Name:			
Title:			

1. ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

1.2 How many years has your organization been in business under its present business name?

1.3 Under what **other** or former names has your organization operated?

1.4 If your organization is a corporation, answer the following:

Date of incorporation:

State of incorporation:

President's name:

Vice-president's name(s):

Secretary's name:

Treasurer's name:

1.5 If your organization is a partnership, answer the following:

Date of organization:

Type of partnership (if applicable):

Name(s) of general partner(s):

1.6 If your organization is individually owned, answer the following:

Date of organization:

Name of owner:

1.7 If the form of your organization is other than those listed above, describe it and name the principals:

2. LICENSING

2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

3. **EXPERIENCE**

3.1 List the categories of work that your organization normally performs with its own forces.

3.2 Has your organization ever failed to complete any work awarded to it? If yes, provide details on a separate sheet. NO: _____ YES: _____

3.3 Are there any judgment, claims, arbitration, proceedings or suits pending or outstanding against your organization or its officers? If yes, provide details. NO: _____ YES: _____

3.4 Within the past five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? If yes, provide details. NO: _____ YES: _____

3.5 Within the last two years, has any owner of any project threatened to impose or imposed liquidated damages against your organization? If yes, provide details. NO: _____ YES: _____

3.6 Within the last two years, has your organization constructed any projects where the date of substantial completion was more than 30 days after the contract completion date as determined by the contract and any changes orders? If yes, provide details. NO: _____ YES: _____

3.7 Within the last 2 years, has your organization constructed any projects where the change orders exceeded 10% of the contract price? If yes, provide details. NO: _____ YES: _____

3.8 State the total worth of work in progress and under contract:

In Progress	$
Under Contract	$

3.9 State the average annual amount of construction work performed during the past five years:

$

4. **FINANCIAL**

4.1 State that you will provide a copy of your firm's audited financial statements for the past two (2) years, if requested, by the City of Rockville. YES:_____ NO: _____

4.2 Is your firm currently for sale or involved in any transaction to expend or to become acquired by another business entity? If yes, please explain the impact both in organizational and directional terms. NO: _____ YES: _____

4.3 Is your firm currently in default on any loan agreement or financing agreement with any bank, financial institution, or other entity? If yes, specify date(s), details, circumstances, and prospects for resolution. NO: _____ YES: _____

5 SAFETY

5.1 Has your organization been cited by OSHA (or State equivalent) in the past five years? If so, provide a copy of the citation(s). NO: _____ YES: _____

5.2 Has your organization experienced a work-related fatality in the past 10 years? If so, provide details. NO: _____ YES: _____

5.3 Provide copies of the last 3-years OSHA Form 300A or OSHA 300 Log. Please omit any personally identifiable or confidential information.

5.4 Provide a copy of your current Workers' Compensation Experience Rating from the NCCI.

5.5 Does your organization have a written safety program? NO: _____ YES: _____

5.5.1 Describe the safety training programs offered to all employees on the elements of the safety program.

5.6.2 When was the last year the written safety program was audited or updated?

5.6.3 Provide an overview of the elements of your written safety program (i.e., table of contents). (This may be returned to non-awarded bidders.)

5.7 Does your organization hire subcontractors? NO: _____ YES: _____

5.7.1 Does your organization conduct pre-contractor qualification of these subcontractors specifically focusing on their safety performance? NO: _____ YES: _____

5.7.2 Describe how your organization manages the safety performance of subcontractors on the jobsite.

5.7.3 Does your organization have a written policy addressing subcontractor's responsibility for complying with OSHA regulations on jobsites? (i.e., OSHA's multi-employer citation policy). NO: _____ YES: _____

CERTIFICATION

The above statements are certified to be true and accurate.

BY:_____

Signature Date

_____

Print Signature/Title

Bidder Reference Form

THIS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL

The City of Rockville reserves the right to reject bids from any company not meeting the minimum qualifications. The Bidder shall be a competent and experienced contractor with an established reputation within the community. The bidder shall have performed similar work for a minimum period of three (3) years. He shall furnish a representative list of five (5) projects involving work as specified, two of which shall be the last jobs completed.

Bidder Name	

#1 Project Name			
Project Owner's Name			
Project Site Address			
Project Owner's Contact Name			
Project Owner's Contact Telephone			
Project Owner's Contact e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			
Name of your project foreman			

#2 Project Name			
Project Owner's Name			
Project Site Address			
Project Owner's Contact Name			
Project Owner's Contact Telephone			
Project Owner's Contact e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			
Name of your project foreman			

#3 Project Name			
Project Owner's Name			
Project Site Address			
Project Owner's Contact Name			
Project Owner's Contact Telephone			
Project Owner's Contact e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			
Name of your project foreman			

#4 Project Name			
Project Owner's Name			
Project Site Address			
Project Owner's Contact Name			
Project Owner's Contact Telephone			
Project Owner's Contact e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			
Name of your project foreman			

#5 Project Name			
Project Owner's Name			
Project Site Address			
Project Owner's Contact Name			
Project Owner's Contact Telephone			
Project Owner's Contact e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			
Name of your project foreman			

SUB-CONTRACTOR REFERENCE FORM

THIS MUST BE COMPLETED AND SUBMITTED WITH YOUR BID PROPOSAL

Be prepared to submit a separate reference form for EACH proposed subcontractor.

Subcontractor's Name	
Address	
Telephone	
Subcontractor's Contact Name	
Description of Work to be Subcontracted	

#1 Reference Organization Name			
Address			
Contact Name			
Contact Name Telephone			
Contact Name e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			

SUB-CONTRACTOR REFERENCE FORM

#2 Reference Organization Name			
Address			
Contact Name			
Contact Name Telephone			
Contact Name e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			

#3 Reference Organization Name			
Address			
Contact Name			
Contact Name Telephone			
Contact Name e-mail			
Contract Value	$		
Scheduled completion date		Percent complete	
Description of Project Work			

Invitation for Bid #11-23
Construction of a Bulk
Sodium Hypochlorite System

SAMPLE
Do Not Complete or Return

CONTRACT PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1)_____ _____ (3)_____of_____ , State of_____ _____ ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the City, dated the _____ day of_____, 2023, a copy of which is hereto attached and made a part hereof for the construction of IFB 11-23: The Construction of a Bulk Sodium Hypochlorite System.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the City, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the City from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the City all outlay and expense which the City may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

CONTRACT PERFORMANCE BOND PAGE 2

PROVIDED, FURTHER, that no final settlement between the City and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in two (2) counterparts, each one of which shall be deemed an original, this the_____ day of_____, 2023.

	_____
ATTEST:	Principal
_____	By_____(Seal)
Corporate Secretary or Asst. Secretary	President or Vice President
_____	_____
(Print or Type Name and Title)	(Print or Type Name and Title)
	_____
	(Address)
	_____
ATTEST:	Surety
_____	By_____(Seal)
Witness as to Surety	Attorney-in-Fact
_____	_____
(Print or Type Name and Title)	(Print or Type Name)
_____	_____
(Address)	(Address)

NOTE: Date of Bond must not be prior to date of Contract.

(2) Correct name of Contractor
(3) A Corporation, a Partnership or an Individual
(4) Name of Surety
(5) Name of City
(6) If Contract is Partnership, all partners should execute bond

SAMPLE
Do Not Complete or Return
CONTRACT PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1)_____ _____ a (2)_____ hereinafter called "Principal" and (3)_____ of_____, State of _____hereinafter called the "Surety", are held and firmly bound unto (4) The Mayor and Council, of Rockville, Maryland, hereinafter called "City", in the penal sum of (*100% of Contract Amount)* ___ ($___) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the City, dated the day of 2023, a copy of which is hereto attached and made a part hereof for the construction of: IFB 11-23: The Construction of a Bulk Sodium Hypochlorite System.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contact or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contact or to the work or to the specifications.
.

CONTRACT PAYMENT BOND PAGE 2

PROVIDED, FURTHER, that no final settlement between the City and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in two (2) counterparts, each one of which shall be deemed an original, this the ____ day of_____ 2023.

ATTEST: _____ Principal

_____ By_____(Seal)
Corporate Secretary or Asst. Secretary President or Vice President

_____ _____
(Print or Type Name and Title) (Print or Type Name and Title)

_____
(Address)

ATTEST: _____ Surety

_____ By_____(Seal)
Witness as to Surety Attorney-in-Fact

_____ _____
(Print or Type Name and Title) (Print or Type Name)

_____ _____
(Address) (Address)

NOTE: Date of Bond must not be prior to date of Contract.
(1) Correct name of Contractor
(2) A Corporation, a Partnership or an Individual
(3) Name of Surety
(4) Name of City
(5) If Contract is Partnership, all partners should execute bon

Department of Public Works
111 Maryland Avenue, Rockville, MD 20850-2364

As-Built Plan Requirements

1. All entities who construct public water or sewer lines, storm drainage systems, bike paths, sidewalks or streets to be maintained by the City of Rockville must submit an "As-built" set of construction drawings for approval as a part of the City's acceptance process. Additionally, entities constructing any stormwater management or stream restoration facilities must submit an "As-Built" set of construction drawings. The initial submittal shall be three (3) sets of "red-lined" marked up prints, which should be delivered to the Department of Public Works counter at City Hall (Attn: Don Jackson, Engineering Technician). This submittal shall include recorded copies of any public easements required with the project.

2. The As-Built drawings shall clearly show any changes or variations from the approved design. Horizontal variations greater that 1.0 foot should be shown dimensionally or through plus stations. Horizontal variations greater than 10.0 feet should also show the graphic relocation of the object. Vertical elevation variations greater than 0.1feet shall be provided for all shown design elevations. A benchmark elevation and benchmark description and location shall also be provided on each plan sheet.

3. As-Built plans for a surface SWM facility shall include the following additional information.

a) Length, width, slope information and depth or contours (1 foot intervals) of the pond area along with a verification of the original design volume.

b) A benchmark on the riser, inlet headwall, or other approved location.

c) Revised design computations verifying the functionality of the pond. Computations shall be submitted directly to the DPW project engineer, along with an additional paper copy of the As-Built plans.

d) The grading/storage volumes must be approved by DPW prior to landscaping/planting. All plantings must be added to the As-Built plans after plant installation. As-Built plans will not be approved without required plantings.

NOTE: As-Built data, which shows that the constructed facility varies from the original design storage elevations by greater than or equal to 10%, will have to be corrected (regraded) prior to submission for review unless storage is verified. All constructed features not previously approved on the original construction drawings may have to be modified at the City's discretion.

4. All As-Built information shall be blocked in and shown on the original construction drawings and shall be blocked in as thus 386.25.

5. The As-Built Certificate (shown on the following page) shall be signed and sealed by a MD professional engineer or a MD professional land surveyor and shall appear on the cover sheet of the As-Built Plan set. All sheets included in the permit set must be submitted in the final as-built set.

6. The City's inspector and project engineer will review the As-Built information. The design engineer will be notified to submit mylars for As-Built approval once all changes have been satisfactorily shown. The As-Built information shall preferably be shown on the original construction drawings (i.e., the original mylars with the permit approval stamp and original P.E. seal). Placing As-Built information upon a scanned image or other reproduction of the original construction drawings is acceptable so long as the quality, integrity, and legibility of the original drawings are substantially preserved without undue compromise. As-Built drawings will be scanned by the City for archiving, so both the As-Built and original information must be sufficiently discernible. The As Built plan set shall be submitted to Department of Public Works Engineering Division (Attn: Don Jackson, Engineering Technician) for signature and shall contain the same red-lined information as approved in the As-Built review. No paper prints, paper or mylar sepias will be accepted.

AS-BUILT CERTIFICATE

I hereby certify that the information shown on this record drawing is an accurate and complete representation of data established from field information obtained under the direction of a Professional Land Surveyor or a Professional Engineer, and that the physical dimensions or elevations shown thus 37.55' are as-built information and the facility was constructed according to the approved plans, except as otherwise noted hereon.

_____	_____
Name	License #
_____	_____
Title	Date

WebDoc 5/14/04

WATER AND/OR SEWERAGE CONSTRUCTION PERMIT

Permit No.: 22-16-1003
Permit Fee: NA

Date Issued: 07/25/2022
Expiration Date: 07/25/2025

This permit authorizes the City of Rockville to construct a water treatment plant together with all appurtenances, at the site Near Intersection of Sandy Landing Road and River Road, Montgomery County, in accordance with an application dated February 15, 2022, and received by the Maryland Department of the Environment on February 15, 2022, titled in part:

ROCKVILLE WATER TREATMENT PLANT
BULK SODIUM HYPOCHLORITE SYSTEM DESIGNS
SHEETS NOS. 1THRU 42 OF 42

THIS PERMIT IS ISSUED SUBJECT TO THE ATTACHED FOLLOWING CONDITIONS:

Note: This permit may be suspended or revoked upon a final, unreviewable determination that the permittee lacks, or is in violation of federal, state or local approval necessary to conduct the activity authorized by this permit.

Walid Saffouri, P.E., Program Administrator
Engineering & Capital Projects Program

Terri Wilson, Director
Office of Budget & Infrastructure Financing

GENERAL CONDITIONS FOR WATER OR SEWERAGE CONSTRUCTION PERMIT

- The structural adequacy and expected performance characteristics of the various components are not certified by this permit.

- This permit is not transferable.

- A copy of this permit must be posted at the work site during construction.

- This permit will expire, if not specifically extended, unless the construction authorized under this permit has been initiated. The permit will then remain valid for the remainder of construction for a period of up to five years from the start of construction.

- If any provision of this permit shall be held invalid for any reason, the remaining provisions shall remain in full force and effect, and such invalid provision shall be considered severed and deleted from this permit.

- Persons violating the requirements of this permit are subject to penalties of up to $1000 per day as set forth in Environment Article 9-268 and 9-334 through 9-342, Annotated Code of Maryland.

- A copy of the plans and specifications, authorized for use under this permit, shall be made available at the work site during construction of this project. A revised construction permit in accordance with COMAR 26.03.12 is required prior to making substantive changes or material alteration to the construction authorized under this permit.

- The owner shall secure all Federal, State or local permits, including approval of Sedimentation and Erosion Control Plans that may be required before starting the construction of the project.

- The owner shall insure that this project is inspected during the progress of construction to assure substantial compliance with the approved plans and specifications. A log and construction records shall be maintained by the inspector and may be requested for review at any time by this office.

- The project engineer of the Maryland Department of the Environment (the 'Department') shall be notified prior to the start of construction.

- Inspectors of the Department shall be afforded access to the project site, at reasonable times and upon presentation of credentials:

  a. to inspect construction authorized under this permit and to determine compliance with applicable regulations;
  b. to have access to and copy any records required to be kept by this permit and by applicable regulations; and
  c. to obtain any photographic documentation or evidence.

- Within 60 days after completion of construction, a copy of as-built drawings and the attached construction completion certificate (page 3 of this permit) shall be submitted to the Department. Where construction was completed in accordance with the original plans approved under this permit, the submittal of as-built drawings will not be required.

- The owner shall maintain a permanent record of the as-built drawings, or the original plans if as-built drawings are not required.

GENERAL CONDITIONS (CONTINUED)

- Pursuant to Labor & Employment Article 9-201, the owner shall ensure that the contractor and subcontractors involved in the construction of this project must carry workers' compensation insurance for their employees. If the owner determines to perform the project construction by his/her labor force, the owner shall provide the same. If the entity, undertaking the project construction, is not covered by a workers' compensation policy, a Certificate of Compliance shall be submitted and approved by the Workers' Compensation Commission before initiation of the construction.

- Approval must be obtained from the Department before this project may be placed into service. Any exception allowing partial use of this project shall have the prior written approval of the Department. Approval may be obtained pursuant to the following procedure:

  a. Where large political subdivisions, commissions, authorities etc. have their own inspection capabilities (satisfactory to the Department), the attached construction completion certificate shall be completed by the director of Public Works or similar responsible person and submitted to the Department.

  b. Where an acceptable local construction inspection program does not exist, the attached construction completion certification shall be completed by a Professional Engineer licensed to practice in the State of Maryland (preferably the same engineer whose seal and signature appear on the plans approved under this permit) and submitted to the Department.

  c. Upon receipt of the signed certificate, the Department shall, within (30) working days of the receipt, 1) issue an approval, 2) require further review and on-site inspection or 3) reject the construction certification. Approval shall be automatic for projects that have not received some form of written notification from the Department within (30) working days of receipt of the signed certificate.

22-16-1003
Permit Number

Fredrick Omanga
Project Engineer
Engineering & Capital Projects Program

WATER AND SEWER CONSTRUCTION COMPLETION CERTIFICATION

The undersigned certifies that the construction authorized by this permit has been completed and inspected and that it substantially meets the terms of Environment Article 9-204, Annotated Code of Maryland.

Signature **Title** **Date**

The above project has been accepted by the Department within the terms of Environment Article 9-204, Annotated Code of Maryland.

Authorized Official **Date**

Complete this certificate and return to:
Maryland Department of the Environment
Engineering & Capital Projects Program (ECPP)
Office of Budget and Infrastructure Financing
1800 Washington Boulevard
Baltimore, MD 21230

06/2022

NOTICE

Prior to starting construction, please notify Fredrick Omanya, Project Engineer at (410) 537- 3787. Upon completion of the project, the construction must be certified with the signed permit returned to this office along with a set of as-built drawings.

Should you have any questions concerning the permit or its conditions, please contact me at (410) 537-3757.

Sincerely,

Walid Saffouri, Program Administrator
Engineering and Capital Projects Program
Office of Budget and Infrastructure Financing

DEPARTMENT OF PERMITTING SERVICES

Marc Elrich
County Executive

Rabbiah Sabbakhan
Director

BUILDING PERMIT

Issue Date: 03/01/2023

Permit No: 995785
AP Type: COMBUILD
Expires: 03/01/2024
X Ref.:
Rev. No:
ID: 1438248

THIS IS TO CERTIFY THAT: _ City of Rockville Department of Public Works
10930 Sandy landing Rd
POTOMAC, MD 20854

HAS PERMISSION TO: ALTER COMMERCIAL MISCELLANEOUS STRUC

PERMIT CONDITIONS: **Customer Wants To Use ePlans Interior work only,This project is an alteration of an existing building at the site of the City of Rockville Water Treatment Plant. The room to be altered currently serves as the storage for chlorine gas for disinfection. The room will be changed to storage and feed (pumped) of sodium hypochlorite (15% concentration).**

MODEL NAME:

PREMISE ADDRESS: 10930 SANDY LANDING RD POTOMAC, MD 20854

LOT - BLOCK:	NA - NA	ZONE:	RE2	ELECTION DISTRICT:	10
BOND NO.:		BOND TYPE:		PS NUMBER:	
PERMIT FEE:	$ 30,887.64	SUBDIVISION:	POTOMAC OUTSIDE		

The permit fee is calculated based on the approved Executive Regulations multiplied by the Enterprise Fund Stabilization Factor for the current fiscal year.

TRANSPORTATION IMPACT TAX DUE:
SCHOOLS IMPACT TAX DUE:
SCHOOLS FACILITY PAYMENT DUE:

MUST BE KEPT AT JOB SITE
AN APPROVED FINAL INSPECTION IS REQUIRED PRIOR TO USE OR OCCUPANCY

Every new one- or two-family dwelling, ***every townhouse*** and any ***attached accessory structure*** must be equipped with a ***fire sprinkler system.*** A separate sprinkler permit is required for the installation of the fire sprinkler system.

Many subdivisions and neighborhoods within Montgomery County have private deed restrictions and covenants regulating building construction. Obtaining a building permit does not relieve the property owner of responsibility for complying with applicable covenants.

NOTICE
THIS APPROVAL DOES NOT INCLUDE PLUMBING, GAS PIPING OR ELECTRICAL OR CONSTRUCTION IN ANY DEDICATED RIGHT-OF-WAY.

NOTE
THIS PERMIT DOES NOT INCLUDE APPROVAL FOR ANY ELECTRICAL WORK. YOU MUST HAVE A SEPARATE ELECTRICAL PERMIT TO DO ANY ELECTRICAL WORK.

Director, Department of Permitting Services

Chapter 31B – Noise Control

Sec. 31B-1. Declaration of policy.

(a) The County Council finds that excessive noise harms public health and welfare and impairs enjoyment of property. The intent of this Chapter is to control noise sources to protect public health and welfare and to allow the peaceful enjoyment of property. This Chapter must be liberally construed to carry out this intent.

(b) The Department of Environmental Protection administers this Chapter.
   (1) The Department must coordinate noise abatement programs of all County agencies, municipalities, and regional agencies.
   (2) A County agency, municipality in which this Chapter applies, or regional authority subject to County law must not adopt a standard or regulation that is less stringent than this Chapter or any regulation adopted under this Chapter.
   (3) The Director may form an Interagency Coordinating Committee to assist the Director in coordinating noise control policy. If the Director forms the Committee, the Director must designate an individual to chair the Committee. The members of the Committee should be designated by County, local, and regional agencies that the Director invites to participate.
   (4) The Department must establish procedures to identify and reduce noise sources when the County plans and issues permits, variances, exemptions, or approvals.
   (5) The Department should make recommendations to the County Executive, County Council, and Planning Board regarding noise control policy, regulations, enforcement, and noise sensitive areas. (1996 L.M.C., ch. 32, § 1.)

Editor's note—See County Attorney Opinion dated 3/16/92 explaining that the Washington Metropolitan Area Transportation Authority (esp. Metrorail) is subject to the County's noise control law, although an exemption may be obtained if it is in the public interest.

Sec. 31B-2. Definitions.

In this Chapter, the following words and phrases have the following meanings:

(a) *Construction* means temporary activities directly associated with site preparation, assembly, erection, repair, alteration, or demolition of structures or roadways.

(b) d*BA* means decibels of sound, as determined by the A-weighting network of a sound level meter or by calculation from octave band or one-third octave band data.

(c) *Daytime* means the hours from 7 a.m. to 9 p.m. on weekdays and 9 a.m. to 9 p.m. on weekends and holidays.

(d) Decibel means a unit of measure equal to 10 times the logarithm to the base 10 of the ratio of a particular sound pressure squared to the standard reference pressure squared. For this Chapter, the standard reference pressure is 20 micropascals.

(e) *Department* means the Department of Environmental Protection.

(f) *Director* means the Director of the Department of Environmental Protection or the Director's authorized designee.

(g) *Enforcement officer* means:
  (1) for a noise originating from any source:
    (A) an employee or agent of the Department designated by the Director to enforce this Chapter;
    (B) a police officer; or
    (C) a person authorized under Section 31B-12(a) to enforce this Chapter;
    (D) a person authorized by a municipality to enforce this Chapter; or
  (2) for a noise originating from an animal source, the Director of the Animal Services Division in the Police Department or the Director's authorized designee.

(h) *Impulsive noise* means short bursts of a acoustical energy, measured at a receiving property line, characterized by a rapid rise to a maximum pressure followed by a somewhat slower decay, having a duration not greater than one second and a field crest factor of 10 dBA or more. Impulsive noise may include, for example, noise from weapons fire, pile drivers, or punch presses.

(i) *Leaf blower* means any portable device designed or intended to blow, vacuum, or move leaves or any other type of unattached debris or material by generating a concentrated stream of air. Leafblower includes devices or machines that accept vacuum attachments.

(j) *Nighttime* means the hours from 9 p.m. to 7 a.m. weekdays and 9 p.m. to 9 a.m. weekends and holidays.

(k) *Noise* means sound, created or controlled by human activity, from one or more sources, heard by an individual.

(l) *Noise area* means a residential or non-residential noise area:
  (1) *Residential noise area* means land in a zone established under Section 59-C-1.1, Section 59-C-2.1, Division 59-C-3, Section 59-C-6.1, Section 59-C-7.0, Section 59-C-8.1, Section 59-C-9.1 for which the owner has not transferred the development rights, or Section 59-C-10.1, or land within similar zones established in the future or by a political subdivision where Chapter 59 does not apply.
  (2) *Non-residential noise area* means land within a zone established under Section 59-C-4.1, Section 59-C-5.1, Section 59-C-9.1 for which the owner has transferred the development rights, or Division 59-C-12, or land in similar zones established in the future or by a political subdivision where Chapter 59 does not apply.

(m) *Noise disturbance* means any noise that is:
  (1) unpleasant, annoying, offensive, loud, or obnoxious;
  (2) unusual for the time of day or location where it is produced or heard; or
  (3) detrimental to the health, comfort, or safety of any individual or to the reasonable enjoyment of property or the lawful conduct of business because of the loudness, duration, or character of the noise.

(n) *Noise sensitive area* means land designated by the County Executive as a noise sensitive area under Section 31B-8.

(o) *Noise-suppression plan* means a written plan to use the most effective noise-suppression equipment, materials, and methods appropriate and reasonably available for a particular type of construction.

(p) *Person* means an individual, group of individuals, corporation, firm, partnership, or voluntary association; or a department, bureau, agency, or instrument of the County or any municipality, or of any other government to the extent allowed by law.

(q) *Prominent discrete tone* means a sound, often perceived as a whine or hum, that can be heard distinctly as a single pitch or a set of pitches. A prominent discrete tone exists if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the sound pressure levels of the 2 contiguous one-third octave bands by:
   (1) 5 dB for center frequencies of 500 Hz and above;
   (2) 8 dB for center frequencies between 160 and 400 Hz; or
   (3) 15 dB for center frequencies less than or equal to 125 Hz.

(r) *Qualifying performing arts facility* means the outdoor area of a building, outdoor seasonal, temporary, or permanent stage, or other clearly defined outdoor area or space, which is:
   (1) used for an outdoor arts and entertainment activity; and
   (2) owned or operated by the County; and
   (3) so designated by the County Executive in an Executive Order published in the County Register. The Executive may revoke a designation at any time by publishing an Executive Order revoking the designation in the County Register.

(s) *Receiving property* means any real property where people live or work and where noise is heard, including an apartment, condominium unit, or cooperative building unit.

(t) *Sound* means an auditory sensation evoked by the oscillation of air pressure.

(u) *Source* means any person, installation, device, or animal causing or contributing to noise. (1996 L.M.C., ch. 32, § 1; 2001 L.M.C., ch. 2, § 1.)

Editor's note—See County Attorney Opinion dated 10/6/00 indicating that long-term parking on public streets is prohibited in certain circumstances, but not based on the size of the vehicle. See County Attorney Opinion dated 3/16/92 explaining that the Washington Metropolitan Area Transportation Authority (esp. Metrorail) is subject to the County's noise control law, although an exemption may be obtained if it is in the public interest.

Sec. 31B-3. Regulations.

The County Executive may establish noise control regulations and standards as necessary to accomplish the purposes and intent of this Chapter. Any regulation must be at least as stringent as this Chapter. The Executive by regulation may set fees that are sufficient to offset the costs of Department reviews or other actions required or authorized by this Chapter. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-4. Noise control advisory board.

(a) A Noise Control Advisory Board must advise the County Executive, Director, County Council, and Planning Board on noise control issues, including administration and enforcement of this Chapter.

(b) The Board consists of 11 members appointed by the Executive and confirmed by the Council.

(c) The Board must elect one member as Chair and another member as Vice-Chair to serve at the pleasure of the Board. The Board must meet at the call of the chairperson as required to perform its duties, but not less than once each quarter. A majority of the members of the

Board constitutes a quorum for transacting business. The Board may act by a majority vote of those present.

(d) At least every third year, the Board must evaluate the effectiveness of the County's noise control program and recommend any improvements to the Director, County Executive, County Council, and Planning Board.

(e) No later than March 1 each year, the Chair of the Board must report to the Director, County Executive, County Council, and Planning Board on activities and actions the Noise Control Advisory Board took during the previous calendar year. (1996 L.M.C., ch. 32, § 1; 1999 L.M.C., ch. 2, § 1.)

Editor's note-1999 L.M.C., ch. 2, § 1, increased the number of Board members from 7 to 11. 1999 L.M.C., ch. 2, § 2, states:

Sec. 2. Transition.

(a) The terms of the 4 members of the Noise Control Advisory Board added by this Act end:
  (1) for 1 member, on September 30, 1999, and every third year thereafter;
  (2) for 2 members, on September 30, 2000, and every third year thereafter; and
  (3) for 1 member, on September 30, 2001, and every third year thereafter.

(b) When appointing the first individual to serve in one of the 4 new positions, the County Executive must designate the term in subsection (a) for which the Executive is appointing the individual.

(c) This Act does not affect the term of any current member of the Board.
Cross reference-Boards and commissions generally, § 2-141 et seq.

Sec. 31B-5. Noise level and noise disturbance violations.

(a) *Maximum allowable noise levels.*
  (1) Except as otherwise provided in Sections 31B-6(a) and 31B-8, a person must not cause or permit noise levels that exceed the following levels:

Maximum Allowable Noise Levels (dBA) for Receiving Noise Areas		
	Daytime	*Nighttime*
Non-residential noise area	67	62
Residential noise area	65	55

  (2) A person must not cause or permit the emission of a prominent discrete tone or impulsive noise that exceeds a level, at the location on a receiving property where noise from the source is greatest, that is 5 dBA lower than the level set in paragraph (1) for the applicable noise area and time.
  (3) Sound that crosses between residential and non-residential noise areas must not exceed the levels set in paragraph (1) for residential noise areas.

(b) *Noise disturbance.* A person must not cause or permit noise that creates a noise disturbance.

(c) *Examples.* The following examples illustrate common noise-producing acts that violate this section if they exceed the noise level standards set in subsection (a) or create a noise

disturbance. The examples are illustrative only and do not limit or expand the noise level or noise disturbance standards of this section:

(1) Sounding a horn or other signaling device on any motor vehicle on private property except:
    (A) in an emergency; or
    (B) as a danger warning signal during daytime hours if the device complies with noise level limits.
(2) Operating a sound-producing device on public streets for commercial advertising or to attract public attention.
(3) Selling anything by outcry.
(4) Loading, unloading, opening, closing or otherwise handling containers, building materials, construction equipment, or similar objects.
(5) Operating a device that produces, reproduces, or amplifies sound.
(6) Allowing an animal to create a noise disturbance.
(7) Operating power equipment mounted on a motor vehicle or operating other devices powered by a generator or a motor vehicle. (1996 L.M.C., ch. 32, § 1.)

Editor's note—See County Attorney Opinion dated 10/6/00 indicating that long-term parking on public streets is prohibited in certain circumstances, but not based on the size of the vehicle. See County Attorney Opinion dated 3/16/92 explaining that the Washington Metropolitan Area Transportation Authority (esp. Metrorail) is subject to the County's noise control law, although an exemption may be obtained if it is in the public interest.

Sec. 31B-6. Noise level and noise disturbance standards for construction.

(a) *Maximum allowable noise levels for construction.*
    (1) A person must not cause or permit noise levels from construction activity that exceed the following levels:
        (A) From 7 a.m. to 5 p.m. weekdays:
            (i) 75 dBA if the Department has not approved a noise-suppression plan for the activity; or
            (ii) 85 dBA if the Department has approved a noise-suppression plan for the activity.
        (B) The level specified in Section 31B-5 at all other times.
    (2) Construction noise levels must be measured at the location, at least 50 feet from the source, on a receiving property where noise from the source is greatest.
    (3) The Department must by regulation establish requirements for noise-suppression plans and adopt procedures for evaluating and approving plans. The regulations must provide that, at least 10 days before approving a noise-suppression plan, the Director must provide public notice reasonably calculated to reach at least a majority of households that might be affected by the construction activity noise levels above 75 dBA.

(b) *Construction noise disturbance.* The prohibition on noise disturbance in Section 31B- 5(b) applies to construction activities, notwithstanding subsection (a).

(c) *Examples.* The following examples illustrate common construction noise-producing acts that violate this section if they exceed the noise level standards set in subsection (a) or create a noise disturbance. The examples are illustrative only and do not limit or expand the construction noise level or noise disturbance standards of this section:
    (1) Delivering materials or equipment, or loading or unloading during nighttime hours in a residential noise area.
    (2) Operating construction equipment with audible back-up warning devices during nighttime hours. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-6A. Seasonal noise level standard for qualifying outdoor arts and entertainment activities.

(a) Each outdoor arts and entertainment activity held at a qualifying performing arts facility must not exceed the following noise decibel limits:
    (1) from 11 a.m. to 11 p.m. during April 1 through October 31, 75 dBA, as measured on the receiving property; and
    (2) at all other times, the maximum allowable noise level set in Section 31B-5.

(b) A qualifying performing arts facility which has complied with this Section must not cause or permit noise levels from an outdoor arts and entertainment activity to exceed the standards in subsection (a).

(c) Any outdoor arts and entertainment activity conducted at a qualifying performing arts facility which has complied with this Section must not be cited as causing a noise disturbance.

(d) The Department must annually advise the Executive and Council, and the operator of each qualifying performing arts facility, whether the noise levels specified in this Section remain appropriate for that facility and the extent of compliance with those levels. (2011 L.M.C., ch. 7, § 1)

Sec. 31B-7. Measurement of sound.

(a) The Department must issue regulations establishing the equipment and techniques it will use to measure sound levels. The Department may rely on currently accepted standards of recognized organizations, including the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), and the United States Environmental Protection Agency.

(b) For multiple sources of sound, the Department may measure sound levels at any point to determine the source of a noise. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-8. Noise sensitive areas.

(a) The County Executive may designate by regulation land within any geographical area as a noise sensitive area to protect public health, safety, and welfare. The regulation may prohibit certain noise producing activities in the noise sensitive area.

(b) A regulation under subsection (a) must:
    (1) describe the area by reference to named streets or other geographic features;
    (2) explain the reasons for the designation;
    (3) establish specific noise limits or requirements that apply in the noise sensitive area; and
    (4) describe by example or enumeration activities or sources that violate the limits or requirements.

(c) A regulation under subsection (a) may establish limits or requirements for a noise sensitive area that are more stringent than those that otherwise would apply to the area under this Chapter. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-9. Leafblowers.

(a) Except as provided in this section, a person must not sell, buy, offer for sale, or use a leafblower at any time that has an average sound level exceeding 70 dBA at a distance of 50

feet. This requirement is in addition to any other noise level or noise disturbance standard that applies under this Chapter.

(b) An individual who owns or occupies a residence in a residential noise area may use at the individual's residence a leafblower bought or manufactured before July 1, 1990, until July 1, 1998, even if it exceeds the standard in subsection (a). After July 1, 1998, a person must not use any leafblower that violates the standard in subsection (a).

(c) The Department must apply the standard in subsection (a) in accordance with the most current leaf-blower testing standard of the American National Standards Institute (ANSI).

(d) The Department may inspect, and on its request a person must produce, any leafblower that is sold, offered for sale, or used in the County, to determine whether the leafblower complies with this section. A person who relies in good faith on a manufacturer's written representation of the sound level of a leafblower that has not been modified is not subject to a penalty for violating this section. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-10. Exemptions.

(a) This Chapter does not apply to:
  (1) agricultural field machinery used and maintained in accordance with the manufacturer's specifications;
  (2) emergency operations by fire and rescue services, police agencies, or public utilities and their contractors;
  (3) a source or condition expressly subject to any State or federal noise-control law or regulation that is more stringent than this Chapter;
  (4) sound, not electronically amplified, created between 7 a.m. and 11 p.m. by sports, amusements, or entertainment events or other public gatherings operating according to the requirements of the appropriate permit or licensing authority. This includes athletic contests, carnivals, fairgrounds, parades, band and orchestra activities, and public celebrations.

(b) The County Executive may issue regulations exempting from Section 31B-5 sources associated with routine residential living during daytime hours, such as home workshops, power tools, and power lawn and garden equipment, when used in accordance with manufacturer specifications. This exception does not apply to repairs or maintenance on a motor vehicle that is not registered for use on public roads. (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-11. Waivers.

(a) *Temporary waiver.*
  (1) The Director may waive any part of this Chapter for a temporary event if the noise the event will create or cause in excess of the limits established under this Chapter is offset by the benefits of the event to the public.
  (2) When the Director receives an application under this subsection, the Director must provide public notice of the application reasonably calculated to reach at least a majority of households that might be affected by noise levels anticipated for the event. The Director must not approve an application under this subsection less than 10 days after the public notice.

(b) *General waiver.*
  (1) The Director may waive any part of this Chapter if the Director determines that compliance in a particular case is not practical and would impose undue hardship.
  (2) When the Director receives an application under this subsection, the Director must schedule a hearing on the application within 60 days.
  (3) At least 30 days before the hearing, the applicant must advertise the hearing by:

(A) placing a display advertisement in a newspaper of general circulation in the community where the source that is the subject of the application is located; and
(B) posting a sign at the location of the source.

(4) Based on evidence presented at the hearing, the Director may grant a waiver for up to 3 years, under terms and conditions appropriate to reduce the impact of the exception.

(5) The Director may renew a waiver granted under this subsection if the applicant shows that the circumstances supporting the original waiver have not changed.

(c) *Violation of waiver.* The Director may suspend, modify, or revoke a waiver granted under this section if a person violates the terms or conditions of the waiver.

(d) *Regulations and fees.* The County Executive must issue regulations implementing this section that:

(1) set the procedures and fees to apply for a waiver under subsections (a) or (b);

(2) require the applicant to use the best technology and strategy reasonably available to mitigate noise, as determined by the Director;

(3) allow temporary waivers under subsection (a) of no more than 30 days, renewable at the discretion of the Director no more than twice; and

(4) specify the requirements for the hearing advertisement and sign required under subsection (b)(3). (1996 L.M.C., ch. 32, § 1.)

Sec. 31B-12. Enforcement and penalties.

(a) The Department must enforce this Chapter. The County Executive may delegate in writing the authority to enforce parts of this Chapter to the Police Department or any other Executive agency.

(b) A violation of this Chapter is a Class A violation. Each day a violation continues is a separate offense. A violation of Section 31B-6 is a separate offense in addition to any other violation of this Chapter arising from the same act or occurrence.

(c) The Department may seek injunctive or other appropriate judicial relief to stop or prevent continuing violations of this Chapter.

(d) If the Director finds that a person has violated this Chapter, the Director may issue a notice of violation and corrective order to the person. The notice must contain the following information:

(1) the section of this Chapter that the person violated;

(2) the date, nature, and extent of the violation;

(3) the action required to correct the violation;

(4) if the Director requires a compliance plan, the deadline for submitting the plan to the Director; and

(5) the deadline for compliance.

(e) The compliance plan referred to in subsection (d)(4) must establish a schedule for achieving compliance with this Chapter, as specified in the corrective order. A compliance plan, and amendments to a plan, are not effective until the Director approves the plan or amendment. An action allowed under an approved compliance plan does not violate this Chapter.

(f) An enforcement officer may issue a civil citation for any violation of this Chapter if the enforcement officer:

(1) witnesses the violation; or

(2) receives complaints from at least 2 witnesses of a noise disturbance. Complaints by 2 witnesses are required to issue a citation under paragraph (2), but are not required to prove that a person violated this Chapter.

(g) The Director of the Animal Services Division may initiate administrative action before the Animal Matters Hearing Board instead of an enforcement officer issuing a citation under subsection (f) for a violation of this Chapter originating from an animal source.

(h) A person aggrieved by any action or order of the Director under Sections 31B-9 and 31B-11 may seek reconsideration within 10 days after the date of the action or order. A request for reconsideration must be in writing to the Director, and must specify the date and nature of the action or order, the injury sustained, the remedy requested, and the legal basis for the remedy. If the Director finds that there are material facts in dispute, the Director may refer the matter to a hearing officer under the procedures specified in Chapter 2A. If the Director finds that there are no material facts in dispute, the Director must make a final decision on the request for reconsideration in writing within 45 days after receiving the request. The aggrieved person may appeal from the Director's final decision within 30 days after the Director issues the decision, as provided in Section 2A-11.

(i) (1) A person responsible for a violation of Section 31B-6 and the person responsible for the management or supervision of the construction site where the source of the violation is located are jointly and severally liable for the violation.

(2) For recurring violations of Section 31B-6 on the same construction site, in addition to any other penalty under this Chapter, the Director may issue a stop work order, as provided in Section 8-20, for up to:

(A) 3 consecutive working days for a second violation within 30 days after the first violation;

(B) 5 consecutive working days for a third violation within 60 days after the first violation; and

(C) 7 working days per offense for the fourth and subsequent violations within a 120-day period.

(3) This Chapter does not limit the Director's authority under Chapter 8 to revoke a permit or approval issued under that Chapter.

(j) Any person aggrieved by a violation of this Chapter may file a civil action in any court with jurisdiction against a person responsible for the alleged violation. The aggrieved person must notify the alleged violator and the Director of the alleged violation at least 60 days before filing the action. A person must not file an action under this subsection if the County Attorney has filed a civil action against the same alleged violator regarding the same violation. (1996 L.M.C., ch. 32, § 1; 2001 L.M.C., ch. 2, § 1.)

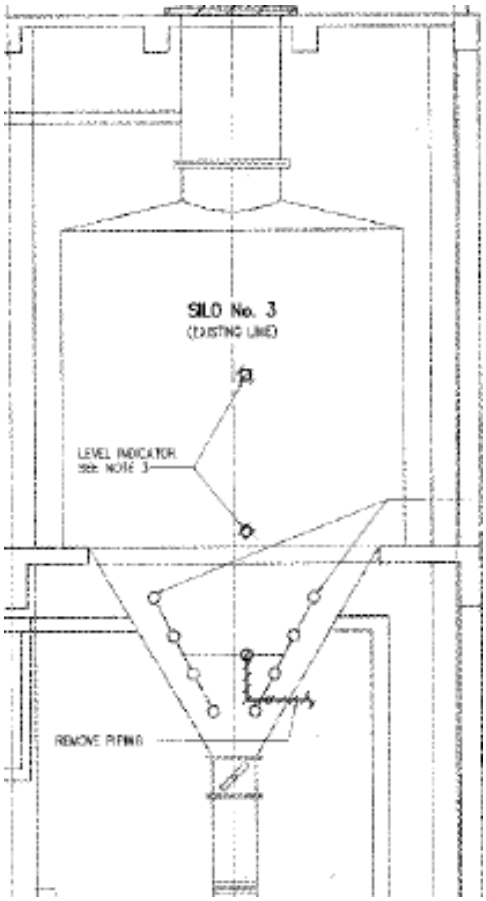
Endnotes

[Note] Editor's note—In Burrows v. United States, 2004 U.S. Dist. LEXIS 1104 (2004), the Court interpreted Montgomery County Code Chapter 31B neither to permit a private cause of action for noise control, nor to permit suit against the federal government. Chapter 31B is discussed in Miller v. Maloney Concrete Company, 63 Md.App. 38, 491 A.2d 1218 (1985). *Cross references-Noise from quarries, § 38-14; radio, etc., without earphones prohibited in public transit facilities, § 54A-2; industrial area noise regulations, § 59-A-5.7.

City of Rockville
Rockville, Maryland

APPENDIX E

Contingent Pay Item
For
Water Treatment Plant – Chemical Building:
Remove and Dispose of Silo #3:



1. INTENT, BACKGROUND AND SCOPE

a. INTENT

The intent of this contingent pay item is to remove and dispose of the third and final silo (Silo #3) within the Chemical Building at Rockville's Water Treatment Plant (WTP). The work requires removal of all appurtenances associated with Silo #3 to include the concrete pad, equipment, materials conduit, feeder chute, hopper and bin. Work also includes a submittal to be signed and sealed by a licensed professional engineering in the State of Maryland for the restoration of the concrete floor (1st floor) and pouring a new concrete floor within the void created by Silo #3.

b. BACKGROUND

The Chemical Building at the WTP was constructed in 1969 when Rockville upgraded the plant capacity from 4 MGD to 8 MGD. Three silos were installed within the building to store Alum (1 bin) and Lime (2 bins – pre and post lime). Two of these silos have been removed and only one remains. The concrete pads for the first two silos have been removed on the first floor and reinforced concrete has been poured on the second floor filling in the voids made by the two silos. All three dust collectors have been removed from the roof and the penetrations sealed.

The Chemical Building is a two-story brick structure with reinforced concrete columns, floors and walls, 34.67-feet wide by 56.33-feet long. The floors, descriptions and elevations are as follows:

- First Floor – chlorine room, ferric chloride day tanks and pumps, and workshop at an approximate elevation of 234.00
- Second Floor – secured equipment storage and material storage at an approximate elevation of 251.50
- Roof – flat roof at an approximate elevation of 267.75
    - Parapet wall elevation is 271.0

The approximate dimensions of Silo #3 are as follows:

- The Feeder Chute and Hopper on the first floor are approximately 18-feet high
- The Bin on the second floor is approximately 8.83-feet in diameter and 12-feet high
- The dust collector tub is approximately 5-feet high

As part of the Ferric Chloride Feed System project, designed in 2013 by Hazen and Sawyer and construction finished in 2017 by CPP Construction, both Silo #1 and #2 were removed out of the Chemical Building including their concrete support pads and all their appurtenances. A reinforced concrete slab section was poured on the second floor, filling in the two voids made by Silo #1 and Silo #2 bins. At that time, the dust collector systems were removed on the roof and penetrations sealed for all three silos. The dust collector tube on Silo #3 remains on its bin within the second floor, but the mechanism was removed on the roof and penetration sealed. At that time during the design, the intent was to salvage Silo #3 for a future Powered Activated Carbon (PAC) system and improvements were made for a feed line, drain line, carbon slurry line, non-potable water service, electrical connections as well as necessary equipment on the concrete support pad. Staff has discussed alternative methods to feed PAC in the event of a treatment need, and that strategy does not include Silo #3. Therefore Silo #3 and its appurtenances are no longer needed, and the silo is empty.

c. SCOPE REQUIREMENTS

Work includes all labor, materials, equipment, tools and services for the removal and disposal of Silo #3 and all associated appurtenances within the Chemical Building at Rockville's WTP. Work shall also include all restoration required to remove the silo's concrete pad (1st floor), pour reinforced concrete slab in void after Silo #3 bin is removed (2nd floor) and patch 4-inch fill pipe hole in concrete floor (2nd floor).

A summary of the work required is as follows, but is not limited to:

- Remove and dispose of Silo #3 and all appurtenances to include the equipment, feeder chute, hopper and bin.
- Disconnect the former dust collector tube from the bin on the second floor and cut at the ceiling elevation.

- Remove and dispose of concrete support pad down to finished floor elevation. Repair, clean, patch, prime and paint disturbed concrete to match the adjacent floor surface.
- Pour new reinforced concrete slab on second floor to fill in Silo void.
- Remove 2” drain conduit and supports in their entirety.
    - Pipe length is approximately 45 feet from where it exists the Chemical Building and terminates in Clarifier Gallery Tunnel
- Remove 2” carbon slurry conduit and supports in their entirety, including the fitting removal at its termination point.
    - Pipe length is approximately 135 feet from where it exists the Chemical Building and terminates in Raw Water Gallery
- Remove ¾” non-potable water line and abandon at source via a plug
- Remove 4” fill pipe, limited to the second floor only.
    - Flush cut on the second floor and cap/seal opening flush with the floor.
- Remove electrical conduit and its support to its termination point within the Chemical Building
- A Professional Engineer licensed in the State of Maryland must provide a PE signed and sealed submittal for the following two items:
    - Patch and repair concrete on the first floor at the pad location (concrete restoration after pad removal)
    - Reinforced concrete slab section on the second floor (fill in void after Silo #3 removal)
    - Second floor concrete repair where 4-inch fill line/pipe penetrates the floor (void after fill pipe removal)

2. SUPPLEMENTAL INFORMATION

a. ENGINEERING DRAWINGS

The following engineering drawings are being provided for informational purposes only.

- Enlargement of Water Treatment Plant
    - Design sheet number WTP-016 dated 1966. This plan is the original construction of the Chemical Building including the plan view, details, sections, and elevations. Total of 37 sheets.
- WTP Ferric Chloride Feed System Project
    - Design sheet number WTP-045 dated 2017. Excerpts from the entire design set are being provided for information relating to the Chemical Building and previous work completed on the three silos. The mechanical and structural drawings are included, totaling 12 sheets. Hazen and Sawyer, as the engineer of record, PE signed and sealed these drawings. Hazen’s details are included for informational purposes only. The awarded contractor must provide their own PE signed and sealed details for use to complete this task, specifically for the first floor concrete pad removal and second floor reinforced concrete slab and 4-inch fill pipe void activities.

b. PICTURES OF EXISTING CONDITIONS

This appendix includes 12 pictures of existing Silo #3 and appurtenances taken on the first and second floor as well as on the roof. Each picture includes a caption which describe the photos.

GENERAL STRUCTURAL NOTES

G-1 THESE NOTES ARE GENERAL AND SUPPLEMENT THE SPECIFICATIONS. THESE NOTES APPLY TO THE ENTIRE PROJECT UNLESS MODIFIED OR NOTED OTHERWISE IN THE CONTRACT DOCUMENTS.

G-2 STANDARD DETAILS SHALL BE USED WHEN REFERRED TO OR WHEN NO MORE RESTRICTIVE OR DIFFERENT DETAILS ARE SHOWN ON THE DRAWINGS.

G-3 DESIGN IS IN ACCORDANCE WITH AND CONSTRUCTION SHALL COMPLY WITH THE PROVISIONS OF THE MARYLAND BUILDING PERFORMANCE STANDARDS WITH APPLICABLE REFERENCES TO THE 2012 INTERNATIONAL BUILDING CODE. THE DESIGN LOADS AND OTHER DESIGN VALUES GIVEN IN NOTES G-4 THROUGH G-7 WERE USED FOR DESIGN OF STRUCTURES UNLESS NOTED OTHERWISE ON THE DRAWINGS.

G-4 LIVE LOADS:

STRUCTURE \ LEVEL	TOP / FIRST FLOOR	BOTTOM / GROUND FLOOR
CHEMICAL BUILDING	200 PSF	N/A
CHEMICAL STORAGE	100 PSF	300 PSF

-ALL STAIRWAYS, LANDINGS AND PLATFORMS ARE DESIGNED FOR A LIVE LOAD = 100 PSF UNLESS NOTED OTHERWISE.

G-8 ALL DIMENSIONS INDICATED (•) SHALL BE VERIFIED EITHER BY FIELD MEASUREMENTS FOR EXISTING STRUCTURES OR BY SHOP DRAWINGS FOR EQUIPMENT FURNISHED. STRUCTURAL DIMENSIONS NOT SHOWN BUT CONTROLLED BY OR RELATED TO EQUIPMENT SHALL BE VERIFIED BY THE CONTRACTOR WITH THE MANUFACTURER PRIOR TO CONSTRUCTION.

G-9 THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL EXISTING INFORMATION IN THE FIELD AS REQUIRED FOR NEW WORK.

G-10 IF A CONFLICT IS FOUND BETWEEN DIFFERENT PORTIONS OF THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY. CONTINUED CONSTRUCTION OF THE AREA IN CONFLICT SHALL BE AT THE CONTRACTOR'S OWN RISK UNTIL THE CONFLICT IS RESOLVED.

G-11 EQUIPMENT ANCHOR BOLT SIZES, TYPES, EMBEDMENT AND PATTERNS SHALL BE VERIFIED WITH THE MANUFACTURER. ALL BOLT PATTERNS SHALL BE TEMPLATED TO INSURE ACCURACY OF PLACEMENT.

G-12 STRUCTURAL DRAWINGS SHALL BE USED IN COORDINATION WITH THE DRAWINGS OF ALL OTHER DISCIPLINES AND MANUFACTURER'S SHOP DRAWINGS.

G-13 STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON THE COMPLETED STRUCTURE. DURING CONSTRUCTION, THE STRUCTURES SHALL BE PROTECTED BY BRACING AND TEMPORARY SUPPORTS WHEREVER EXCESSIVE CONSTRUCTION LOADS MAY OCCUR. OVERSTRESSING OF ANY STRUCTURAL ELEMENT IS PROHIBITED.

G-14 NO BACKFILL SHALL BE PLACED AGAINST ANY SUBSTRUCTURE WALLS UNLESS ALL ADJACENT SUPPORTING ELEMENTS HAVE ACHIEVED DESIGN STRENGTH, OR WALLS HAVE BEEN PROPERLY BRACED, AND IN ANY CASE NOT SOONER THAN 28 DAYS AFTER THE PLACING OF CONCRETE UNLESS APPROVED BY THE ENGINEER. SUPPORTING ELEMENTS SHALL INCLUDE ADJACENT WALLS.

G-15 LEAKAGE TESTING OF HYDRAULIC STRUCTURES SHALL NOT BEGIN UNTIL ALL STRUCTURAL ELEMENTS HAVE REACHED THE SPECIFIED MINIMUM CONCRETE STRENGTH.

G-16 SNOW LOAD:

GROUND SNOW LOAD (Pg) = 30 PSF
FLAT-ROOF SNOW LOAD (Pf) = 31 PSF
SNOW EXPOSURE FACTOR (Ce) = 1.1
SNOW LOAD IMPORTANCE FACTOR (Is) = 1.1
THERMAL FACTOR (Ct) = 1.2

G-17 WIND DESIGN CRITERIA:

ULTIMATE DESIGN WIND SPEED = 120 MPH
WIND IMPORTANCE FACTOR (Iw) = 1.00
WIND EXPOSURE = C

STRUCTURE \ PARAMETER	PRESSURE COEFFICIENT GCpi	WIND DESIGN PRESSURE	COMPONENTS AND CLADDING	LATERAL LOAD RESISTING SYSTEM
CHEMICAL STORAGE	N/A	28 PSF	N/A	CONCRETE SHEAR WALL

G-18 SEISMIC LOAD:

OCCUPANCY CATEGORY = III
SEISMIC IMPORTANCE FACTOR (Ie) = 1.25
SITE CLASS = C
MAPPED SPECTRAL RESPONSE ACCELERATIONS (Ss/S1) = 0.125g/0.055g
SPECTRAL RESPONSE ACCELERATIONS (SMS/SM1) = 0.150g/0.094g
SPECTRAL RESPONSE COEFFICIENTS (SDS/SD1) = 0.100g/0.063g
SEISMIC DESIGN CATEGORY = A

STRUCTURE \ PARAMETER	BASIC STRUCTURAL SYSTEM	DESIGN BASE SHEAR	SEISMIC RESPONSE COEFFICIENT Cs	RESPONSE MODIFICATION COEFFICIENT R	ANALYSIS PROCEDURE
CHEMICAL STORAGE	CONCRETE SHEAR WALL	6 K	0.03	2.0	EQUIVALENT LATERAL FORCE

CONCRETE (CAST-IN-PLACE)

C-1 DESIGN OF CONCRETE ELEMENTS INCLUDING WALLS, FORMED SLABS, BEAMS, AND COLUMNS IS IN ACCORDANCE WITH ACI 318 (CODE REQUIREMENTS FOR STRUCTURAL CONCRETE) AND 350 (CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES).

C-2 FOR CONCRETE MIX DESIGN SEE SPECIFICATION SECTION 03300.

C-3 CONCRETE STRENGTH CLASSES (28-DAY COMPRESSIVE STRENGTH):

A) CLASS A1 CONCRETE (4,500 PSI): NORMAL WEIGHT CONCRETE SHALL BE USED IN ALL STRUCTURES, SIDEWALKS, PAVEMENTS, EXCEPT WHERE NOTED OTHERWISE IN CONTRACT DOCUMENTS. ALL CONCRETE SHALL BE CLASS A1 CONCRETE UNLESS ANOTHER CLASS IS SPECIFICALLY CALLED FOR ON CONTRACT DOCUMENTS OR SPECIFIED HEREIN.

B) CLASS A3 CONCRETE (4,500 PSI): NORMAL WEIGHT STRUCTURAL CONCRETE TO BE USED WHERE SPECIFICALLY CALLED FOR ON CONTRACT DRAWINGS OR WHERE SPECIFICALLY REQUESTED BY CONTRACTOR AND APPROVED BY ENGINEER. CLASS A3 CONCRETE SHALL BE SIMILAR TO CLASS A1 EXCEPT CLASS A3 CONCRETE SHALL CONTAIN A MANDATORY ADDITION OF HIGH RANGE WATER REDUCER TO AID IN PLACEMENT OF CONCRETE.

C) CLASS A4 CONCRETE (4,500 PSI): NORMAL WEIGHT STRUCTURAL CONCRETE TO BE USED WHERE SPECIFICALLY CALLED FOR ON CONTRACT DRAWINGS OR AREAS WHERE SPECIFICALLY REQUESTED BY CONTRACTOR AND APPROVED ENGINEER. CLASS A4 CONCRETE IS IDENTICAL TO CLASS A1 CONCRETE EXCEPT THAT COARSE AGGREGATE SHALL BE SIZE #8M IN ACCORDANCE WITH ASTM C33. CLASS A4 CONCRETE MAY ALSO REQUIRE A MANDATORY ADDITION OF HIGH RANGE WATER REDUCER TO AID IN PLACEMENT OF CONCRETE.

D) CLASS A6 CONCRETE (4,500 PSI): NORMAL WEIGHT STRUCTURAL CONCRETE USED WHERE CONCRETE IS PLACED UNDER PRESSURE (PUMPED). CLASS A6 CONCRETE SHALL BE USED ONLY WHERE SPECIFICALLY APPROVED BY ENGINEER.

E) CLASS B CONCRETE (3,000 PSI): NORMAL WEIGHT STRUCTURAL CONCRETE USED FOR DUCT BANK ENCASEMENTS, CATCH BASINS, FENCE AND GUARD POST EMBEDMENT, CONCRETE FILL AND OTHER AREAS WHERE SPECIFICALLY NOTED ON CONTRACT DRAWINGS.

C-4 ALL BAR REINFORCING SHALL CONFORM TO ASTM A615, GRADE 60. WHERE REINFORCEMENT IS TO BE WELDED IN ACCORDANCE WITH AWS D1.4, ASTM A706 GRADE 60 SHALL BE USED. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.

C-5 CONCRETE COVER FOR REINFORCING (UNLESS NOTED OTHERWISE ON THE DRAWINGS):

A)	CONCRETE DEPOSITED DIRECTLY AGAINST SOIL:	3"
B)	CONCRETE EXPOSED TO WEATHER (#5 OR SMALLER):	1 1/2"
	CONCRETE EXPOSED TO WEATHER (#6 OR LARGER):	2"
C)	SLABS:	1 1/2"
	AT SURFACES CONTACTING FLUID:	2"
D)	BEAMS (TO MAIN REINFORCEMENT):	2"
	BEAMS (STIRRUPS):	1 1/2"
E)	WALLS 12" OR MORE:	2"
	WALLS LESS THAN 12" (#5 OR SMALLER):	1 1/2"
	WALLS LESS THAN 12" (#6 OR LARGER):	2"
F)	FOR SURFACES EXPOSED TO FLUID IN BEAMS, COLUMNS AND WALLS:	ADD 1/2" TO ABOVE VALUES

C-6 SPLICES SHALL BE CLASS 'B' CONFORMING TO THE PROVISIONS OF ACI 318 UNLESS NOTED OTHERWISE.

C-7 CONSTRUCTION JOINTS SHALL BE SUBMITTED BY THE CONTRACTOR FOR THE APPROVAL OF THE ENGINEER PRIOR TO SUBMITTING REBAR SHOP DRAWINGS. VERTICAL CONSTRUCTION JOINTS IN WALLS AND HORIZONTAL JOINTS IN SLABS SHALL BE PROVIDED AT A SPACING NOT GREATER THAN 45 FEET ON CENTER. FOR EXPOSED WALLS WITH FLUID OR EARTH ON THE OPPOSITE SIDE, THE SPACING BETWEEN VERTICAL AND HORIZONTAL JOINTS SHALL BE A MAXIMUM OF 25 FEET.

C-8 WHERE HORIZONTAL CONSTRUCTION JOINTS, LOCATED ABOVE THE FOUNDATION SLAB, EXTEND BEYOND WHERE NEEDED, THEY SHALL BE TERMINATED AT A VERTICAL CONSTRUCTION JOINT APPROVED BY THE ENGINEER.

C-9 ALL JOINTS WHICH ARE IN MEMBERS IN CONTACT WITH LIQUID OR BELOW GRADE SHALL HAVE A WATERSTOP. CONSTRUCTION JOINTS SHALL HAVE A 6" PVC RIBBED WATERSTOP. EXPANSION JOINTS SHALL HAVE A 9" PVC CENTER BULB RIBBED WATERSTOP. IN VERTICAL JOINTS, WATERSTOPS SHALL TERMINATE NO LESS THAN 18" ABOVE THE MAXIMUM WATER SURFACE OR 18" ABOVE GRADE, WHICHEVER IS HIGHER.

C-10 SLABS WITH SLOPING SURFACES SHALL HAVE THE INDICATED SLAB THICKNESS MAINTAINED AS THE MINIMUM. SLAB BOTTOMS CAN EITHER SLOPE WITH THE TOP SURFACE OR BE LEVEL. REINFORCEMENT IN SLABS WITH SLOPING SURFACES SHALL BE PLACED AT THE REQUIRED CLEARANCE FROM THE SLAB SURFACE.

C-11 ALL EXPOSED CORNERS SHALL HAVE A 3/4" CHAMFER OR A 1/2" RADIUS TOOLED CORNER.

C-12 EQUIPMENT SUPPORTS, ANCHORAGES, OPENINGS, RECESSES AND REVEALS NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER CONTRACT DOCUMENTS, SHALL BE PROVIDED FOR PRIOR TO PLACING CONCRETE.

C-13 REINFORCING BARS AND ACCESSORIES SHALL NOT BE IN CONTACT WITH ANY METAL PIPE, PIPE FLANGE, METAL CONDUIT, OR OTHER METAL PARTS EMBEDDED IN CONCRETE. A MINIMUM CLEARANCE OF 2" SHALL BE PROVIDED.

C-14 DOWELS, ANCHOR BOLTS, PIPES, WATERSTOPS AND OTHER EMBEDDED ITEMS SHALL BE HELD SECURELY IN POSITION WHILE CONCRETE IS BEING PLACED.

C-15 CONDUITS AND OTHER SIMILAR ITEMS EMBEDDED IN OR PENETRATING THROUGH CONCRETE SHALL BE SPACED ON CENTER NOT LESS THAN 3 TIMES THEIR OUTSIDE DIMENSION, BUT NOT LESS THAN 2 1/2" CLEAR. WHEN SUCH ITEMS ARE EMBEDDED IN WALLS OR SLABS, THEY SHALL NOT OCCUPY MORE THAN 1/3 OF THE MEMBER THICKNESS.

C-16 AT ALL TYPICAL CURBS, EQUIPMENT PADS, AND PIPE SUPPORT PIERS, REINFORCING DOWELS SHOWN MAY BE REPLACED WITH MATCHING DOWELS SET IN EPOXY IN DRILLED HOLES AS SPECIFIED. DOWELS LOCATED CLOSER THAN 3" FROM ANY EDGE OF CONCRETE SHALL NOT BE REPLACED WITH DRILLED DOWELS.

C-17 DRILLED ADHESIVE DOWELS (WHERE DOWELS ARE SHOWN TO BE PLACED INTO HARDENED CONCRETE):

A) THE HOLE DIAMETER SHALL BE NO LARGER THAN 1/8" GREATER THAN THE DIAMETER OF THE REINFORCING BAR AT THE DEFORMATIONS.
B) THE DEPTH OF EMBEDMENT SHALL BE 12 BAR DIAMETERS, UNLESS NOTED OTHERWISE.
C) ADJUST THE DOWEL LOCATIONS AS NEEDED TO AVOID DRILLING THROUGH ANY REINFORCING BARS. IF THE LOCATION NEEDS TO BE MODIFIED, CONTACT THE ENGINEER.

C-18 CLEAR DISTANCE FROM ANCHOR BOLTS TO ANY CONCRETE EDGE SHALL BE 4" MINIMUM UNLESS NOTED OTHERWISE.

C-19 CONCRETE COMPRESSIVE STRENGTH TESTS SHALL BE AVAILABLE ON THE JOB SITE FOR REVIEW BY THE ENGINEER.

FOUNDATIONS

F-1 CONCRETE (CAST-IN-PLACE) NOTES APPLY TO FOUNDATIONS.

F-2 PRESUMPTIVE SOIL BEARING PRESSURE

STRUCTURE \ PARAMETER	PRESUMPTIVE SOIL BEARING PRESSURE
CHEMICAL STORAGE	2,000 PSF

F-3 MINIMUM DEPTH FROM ADJACENT FINISHED GRADE TO BOTTOM OF FOUNDATION = 30 INCHES.

F-4 SOFT OR LOOSE SOILS MAY BE ENCOUNTERED DURING EARTHWORK OPERATIONS, REQUIRING ADDITIONAL UNDERCUTTING AND FILL.

F-5 GROUNDWATER CONTROL MAY BE REQUIRED DURING CONSTRUCTION.

DEMOLITION

D-1 FOR DEMOLITION REQUIREMENTS, REFER TO SPECIFICATION 01540 – DEMOLITION AND REMOVAL OF EXISTING STRUCTURES AND EQUIPMENT.

D-2 CONCRETE DEMOLITION WITHIN STRUCTURES BEING MODIFIED SHALL BE SELECTIVE DEMOLITION BY CORE DRILLING OR SAWCUTTING AND CAREFUL REMOVAL OF CONCRETE SHOWN TO BE REMOVED. NO OVER CUTTING OF AREAS TO BE DEMOLISHED SHALL BE PERMITTED. CONTRACTOR SHALL CORE DRILL CORNERS OF OPENING PRIOR TO SAWCUTTING IF NECESSARY. VIBRATORY HAMMERS SHALL NOT BE USED FOR SELECT DEMOLITION WORK. JACK HAMMERS, HOE RAMS AND OTHER HIGH ENERGY DEMOLITION EQUIPMENT MAY BE USED FOR COMPLETE REMOVAL OF A STRUCTURE. EXPLOSIVES SHALL NOT BE USED FOR ANY DEMOLITION.

D-3 UNLESS ANCHORING DEVICES AND/OR REINFORCEMENT ARE NOTED TO REMAIN FOLLOWING DEMOLITION, REMOVE AND/OR BURN BACK ANCHORS AND REINFORCEMENT STEEL 1/2" MIN BELOW SURFACE. VOIDS CREATED SHALL BE FILLED WITH EPOXY RESIN BINDER.

D-4 WHERE DRAWINGS INDICATE A CONCRETE EQUIPMENT PAD TO BE DEMOLISHED, THE FLOOR SLAB SURFACE SHALL BE REPAIRED AS APPROVED BY ENGINEER. FOLLOWING SELECT DEMOLITION AND REMOVAL OF THE EQUIPMENT PAD, THE FLOOR SLAB SURFACE SHALL BE INSPECTED. IF THE FLOOR SLAB IS DAMAGED FROM THE EQUIPMENT PAD REMOVAL THE REPAIR SHALL BE:

A) SAW CUT THE FLOOR SLAB AROUND THE EQUIPMENT PAD PERIMETER TO A DEPTH OF 1/4 INCH.
B) SCARIFY AND REMOVE SLAB CONCRETE WITHIN THE PERIMETER TO A NOMINAL 1/4 INCH DEPTH. CLEAN AND REMOVE ALL CONCRETE LAITANCE.
C) RESURFACE THE AREA BY APPLYING A POLYMER MODIFIED OR SILICA FUME ENHANCED CEMENTITIOUS REPAIR MORTAR, APPROVED BY THE ENGINEER, FOLLOWING THE MANUFACTURERS SURFACE PREPARATION AND APPLICATION RECOMMENDATIONS. LEVEL AND FINISH THE SURFACE TO MATCH THE FLOOR SLAB SURROUNDING AREA.

D-5 CONCRETE SURFACES LEFT EXPOSED FOLLOWING DEMOLITION SHALL BE SEALED WITH A HIGH-BUILD, MOISTURE TOLERANT, EPOXY RESIN COATING. THE COATING SHALL BE SIKAGUARD 62 BY SIKA CORPORATION OR APPROVED EQUAL. FOR POTABLE WATER APPLICATIONS, REQUIREMENTS OF ANSI/NSF STANDARD 61 SHALL BE SATISFIED.

D-6 A DETAILED CONSTRUCTION AND DEMOLITION PLAN SHALL BE SUBMITTED TO THE ENGINEER AND APPROVED BY THE ENGINEER AND OWNER PRIOR TO BEGINNING CONSTRUCTION. ANY SHUTDOWNS SHALL BE SUBMITTED TO, COORDINATED WITH, AND APPROVED BY THE OWNER. ONCE APPROVED, CONTRACTOR SHALL PROVIDE A MINIMUM OF THREE (3) WEEKS NOTICE TO OWNER PRIOR TO SHUTDOWN, SEE SPECIFICATION SECTION 01520.

D-7 REPAIR ALL CONCRETE DAMAGED DURING DEMOLITION OPERATIONS. THE CONTRACTOR SHALL GUARANTEE ALL REPAIR WORK AGAINST DEFECTS IN WORKMANSHIP (INCLUDING FAILURE OF CONCRETE BOND) FOR A PERIOD OF 2 YEARS FROM THE DATE OF THE CERTIFICATE OF SUBSTANTIAL COMPLETION. THE CONTRACTOR SHALL SUBMIT TECHNICAL DATA ON ALL REPAIR MATERIALS FOR APPROVAL. THE SUBCONTRACTOR/APPLICATOR SHALL SUBMIT A LETTER FROM THE MANUFACTURER STATING THAT HE IS ON THE MANUFACTURER'S APPROVED LIST OF CONTRACTORS.

EXISTING INFORMATION

X-1 ALL EXISTING INFORMATION SHOWN ON THESE DRAWINGS INCLUDING LOCATION, DIMENSIONS, ELEVATIONS, AND CONFIGURATIONS IS DERIVED FROM THE 1967 BAKER-WIBBERLY & ASSOCIATES, INC AS BUILT DRAWINGS AND THE 1957 GILBERT ASSOCIATES, INC CONTRACT DRAWING AND IS NOT GUARANTEED TO BE COMPLETE OR CORRECT.

X-2 THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL EXISTING INFORMATION IN THE FIELD AS REQUIRED FOR DEMOLITION AND MODIFICATIONS.

SPECIAL INSPECTIONS

SI-1 SPECIAL PERIODIC AND CONTINUOUS INSPECTIONS SHALL BE IN ACCORDANCE WITH SPECIFICATIONS AND THE MARYLAND BUILDING PERFORMANCE STANDARDS. PERIODIC INSPECTION OF REINFORCING STEEL ARE REQUIRED. CONTINUOUS INSPECTION OF WELDED REINFORCEMENT STEEL IS REQUIRED.

MASONRY

M-1 MASONRY TRUSS TYPE REINFORCEMENT SHALL CONFORM TO ASTM A 82 AND REINFORCEMENT STEEL SHALL CONFORM TO REQUIREMENTS OF ASTM A 615 FOR GRADE 60 BILLET STEEL.

M-2 MASONRY REINFORCEMENT BAR SPLICES SHALL BE CONTACT SPLICES. LENGTH OF SPLICE FOR SINGLE BARS IN CENTER OF CELLS OF 8" OR LARGER CMU SHALL BE A MINIMUM 45 INCHES FOR #5 BARS.

M-3 DOWELS SHALL BE INSTALLED WITH A DOWEL ADHESIVE SYSTEM DOWELS AND SHALL BE STRAIGHT BARS EMBEDDED A MINIMUM OF 10" INTO STEM WALL. DOWEL ADHESIVE SHALL BE QUALIFIED FOR USE UNDER SEISMIC LOADING IN BOTH CRACKED AND UNCRACKED CONDITIONS FOR ALL SEISMIC DESIGN CATEGORIES IN ACCORDANCE WITH SPECIFICATION 03200. INSTALLATION OF ALL DOWELS SHALL BE PER MANUFACTURERS RECOMMENDATIONS. AS A MINIMUM THE FOLLOWING INSTALLATION REQUIREMENTS SHALL BE MET:

A) HOLES SHOULD BE DRILLED WITH CARBIDE BIT UNLESS OTHERWISE RECOMMENDED BY THE MANUFACTURER.
B) ALL HOLES SHALL BE CLEANED USING COMPRESSED AIR AND A PROPERLY SIZED NYLON OR WIRE BRUSH.
C) ADHESIVE SHALL BE INJECTED USING A DISPENSER, STATIC MIXING NOZZLE AND A PISTON PLUG TO MINIMIZE THE FORMATION OF AIR POCKETS PROVIDED BY THE MANUFACTURER. IF DEPTH OF HOLE IS DEEPER THAN THE STATIC MIXING NOZZLE A PLASTIC EXTENSION TUBE SUPPLIED BY THE MANUFACTURER SHALL BE USED FOR PLACING ADHESIVE.

NONSTRUCTURAL COMPONENT ANCHORAGE

A-1 ALL ARCHITECTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS SHALL BE DESIGNED AND INSTALLED TO RESIST THE CONTROLLING CONDITION OF OPERATIONAL FORCES OR SEISMIC FORCES IN ACCORDANCE WITH GOVERNING BUILDING CODE. SEISMIC FORCES SHALL ALSO BE AS PER ASCE 7. COMPONENT SEISMIC ATTACHMENTS SHALL BE BOLTED, WELDED, OR OTHERWISE POSITIVELY FASTENED WITHOUT CONSIDERATION OF FRICTIONAL RESISTANCE PRODUCED BY THE EFFECTS OF GRAVITY. A CONTINUOUS LOAD PATH OF SUFFICIENT STRENGTH AND STIFFNESS BETWEEN THE COMPONENT AND THE SUPPORTING STRUCTURE SHALL BE PROVIDED. CONNECTIONS FOR BOTH ORTHOGONAL DIRECTIONS (TRANSVERSE AND LONGITUDINAL) SHALL BE DESIGNED BY THE CONTRACTOR'S ENGINEER CURRENTLY REGISTERED IN THE STATE OF MARYLAND.

A-2 COMPONENT REACTION FORCES AT THE POINT OF ATTACHMENT TO THE STRUCTURE SHALL BE SUBMITTED TO AND COORDINATED WITH THE ENGINEER FOR CONFIRMATION SUPPORTING STRUCTURE CAN WITHSTAND REACTION FORCES.

STATE OF MARYLAND — WILLIAM LADDOMADA — No. 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/4/13

STATE OF MARYLAND — WILLIAM LADDOMADA — No. 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

4/4/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	LBC	APPROVED	4-4-13 DATE
DRAFTED	KJO		DIRECTOR OF PUBLIC WORKS
CHECKED	WGL		

GRAD. ____ PAV. ____ SD ____ W & S ____ SWM ____ OTHER ____

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED ____
DATE PROJECT COMPLETED ____
DATE ACCEPTED BY CITY ____
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM ____

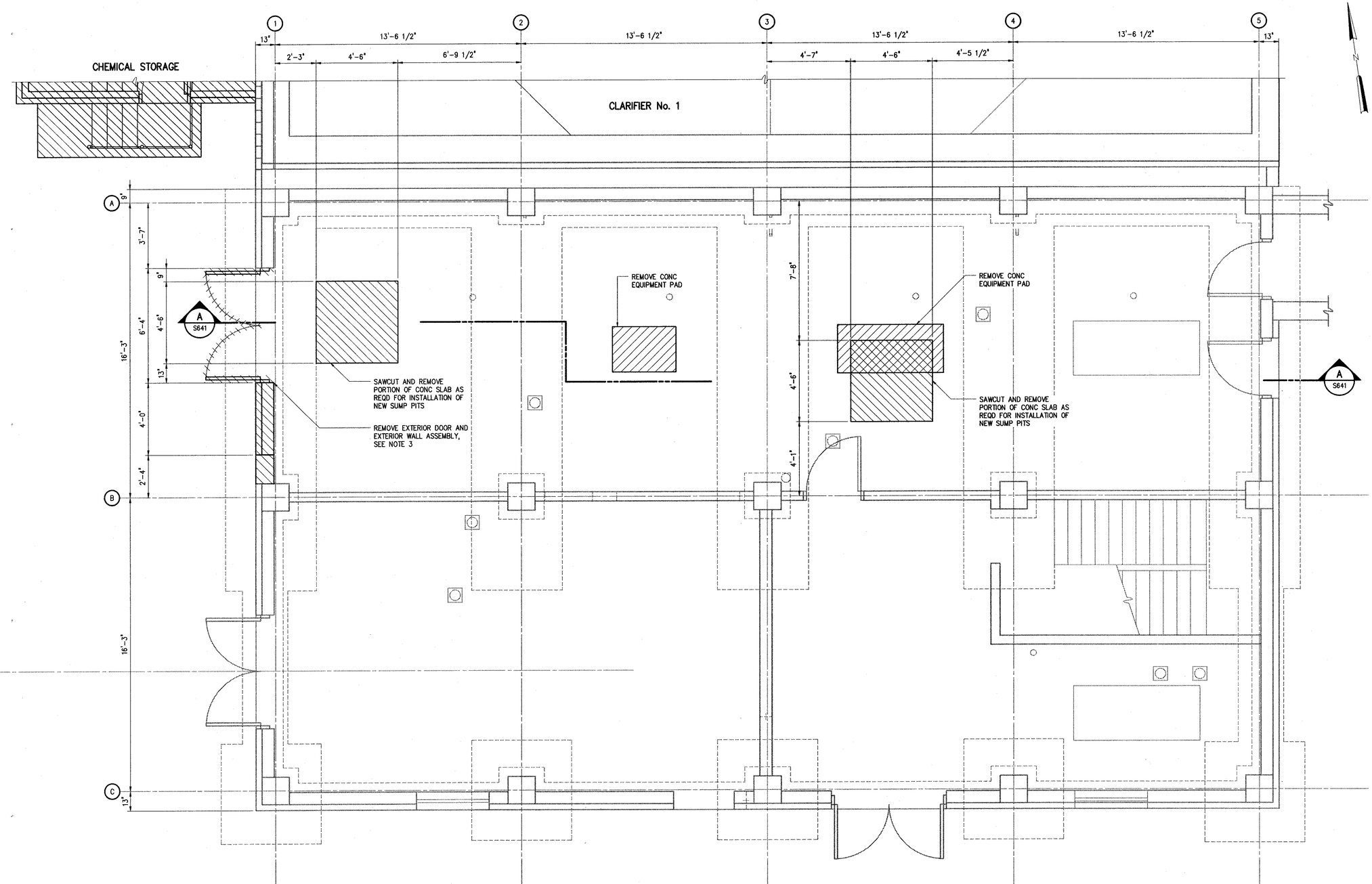
AS BUILT COMPLETED ____ DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
GENERAL STRUCTURAL NOTES

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWINGS WTP-46		6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

DATE: FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 20 OF 46
DRAWING NUMBER: S1

RECORD DRAWINGS



NOTES:

1. SEE DEMOLITION NOTES ON DRAWING S1.
2. CONTRACTOR SHALL TAKE MEASURES TO PROTECT SUBGRADE UNDER EXISTING SLAB TO PREVENT UNDERMINING.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR SELECTING MEANS AND METHODS FOR TEMPORARY SHORING THE EXISTING CMU WALL AND BRICK PRIOR TO LINTEL BEING PLACED.

DEMOLITION BOTTOM PLAN

3/8" = 1'-0"

3/8"=1'-0" 12" 0 1 2 4'

STATE OF MARYLAND — WILLIAM G. LEADBETTER — 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

William D. Leadbetter 3/26/13

STATE OF MARYLAND — GREGORY L. HANSON — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/4/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

Gregory L. Hanson 4/4/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	LBC	APPROVED 4-4-13 DATE	GRAD.
DRAFTED	KJO		PAV.
CHECKED	WGL	DIRECTOR OF PUBLIC WORKS	SD
			W & S
			SWM
			OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – DEMOLITION – BOTTOM PLAN

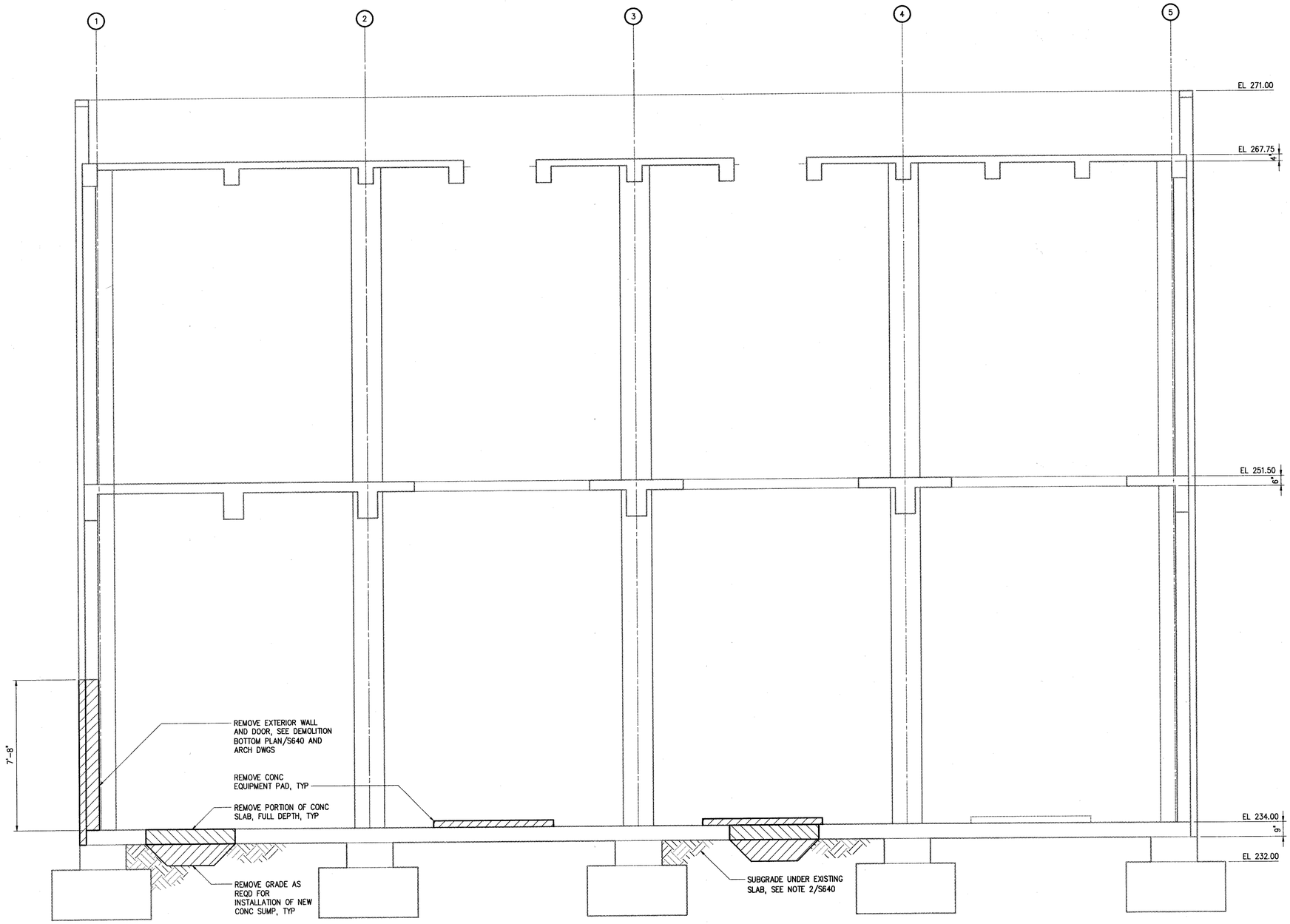
NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWING WTP-45		6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 21 OF 46
DRAWING NUMBER S640

RECORD DRAWINGS

NOTES:

1. SEE NOTES ON DRAWING S640.



SECTION A/S640
3/8" = 1'-0"

3/8"=1'-0"

12" 0 1 2 4'

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

William D. Leahy 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

Gordon D. Hagen 4/2/13

STATE OF MARYLAND — GORDON D. HAGEN — NO. 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — WILLIAM D. LEAHY — NO. 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

NO.	REVISIONS	APP'D	DATE
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013
3	RECORD DRAWING WTP-45		6/30/17

DESIGNED LBC
DRAFTED KJO
CHECKED WGL

APPROVED 4-4-13 DATE
DIRECTOR OF PUBLIC WORKS

GRAD. ____
PAV. ____
SD ____
W & S ____
SWM ____
OTHER ____

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

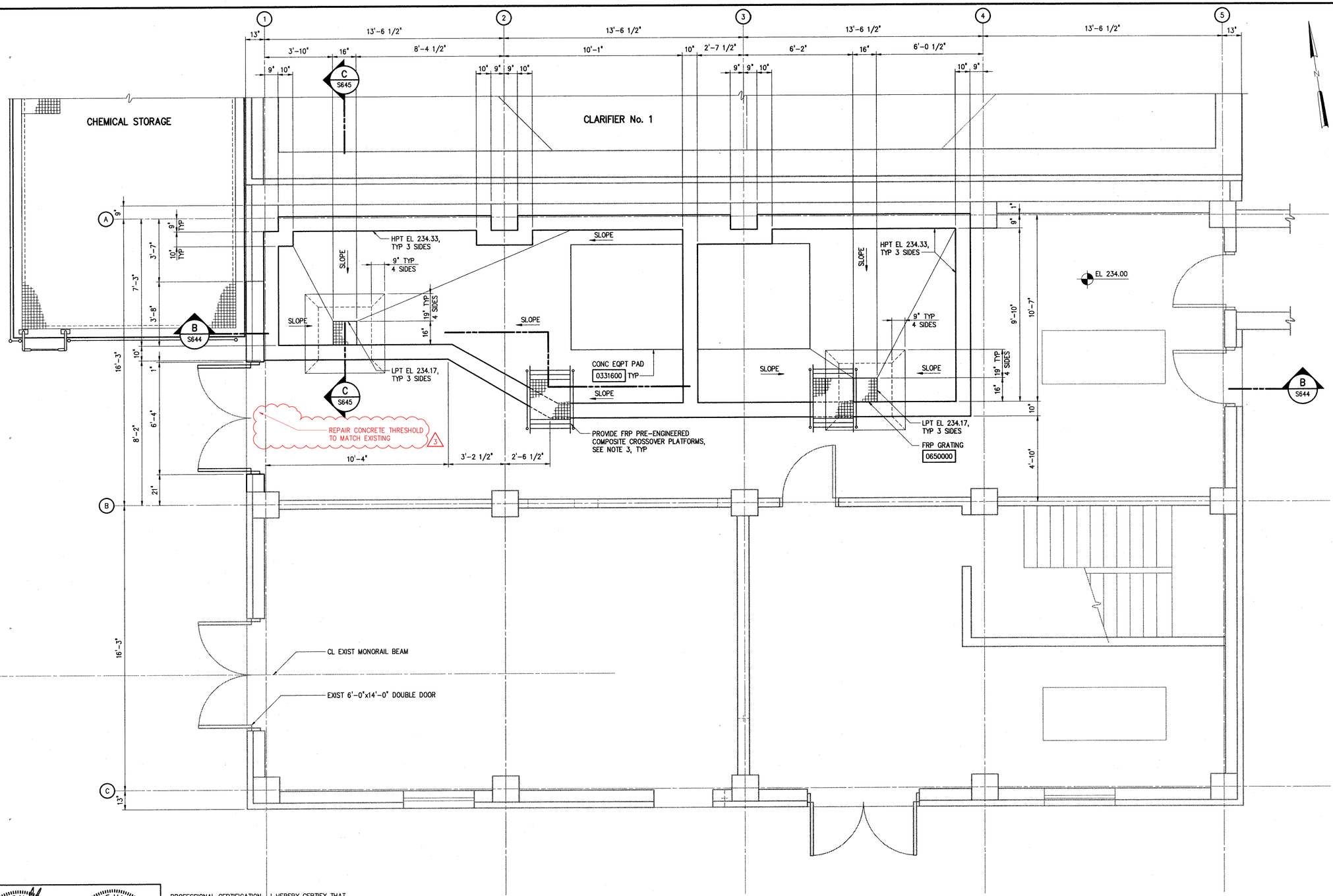
DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – DEMOLITION – SECTIONS

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 22 OF 46
DRAWING NUMBER S641

RECORD DRAWINGS



BOTTOM PLAN
3/8" = 1'-0"

NOTES:

1. CONTRACTOR SHALL COORDINATE PAD SIZE WITH EQUIPMENT MANUFACTURER.
2. CONTRACTOR SHALL FIELD VERIFY LAYOUT OF PROPOSED 10" WIDE BY 2'-0" HIGH CONCRETE CONTAINMENT WALL.
3. PRE-ENGINEERED COMPOSITE CROSSOVER PLATFORMS SHALL BE MANUFACTURED BY FIBERGRATE COMPOSITE STRUCTURES OR EQUAL. CROSSOVER PLATFORMS SHALL PROVIDE A 2'-0" CLEARANCE OVER THE CONTAINMENT WALL, 2'-0" MINIMUM WALKWAY WIDTH, AND 2'-0" MINIMUM GRATING LANDING LENGTH. CROSSOVER PLATFORMS SHALL INCLUDE HANDRAIL ON EACH SIDE, A MINIMUM OF 3 EQUALLY SPACED RISERS, AND FIBERGLASS FASTENERS. SEE SPECIFICATION 06610 FOR ADDITIONAL INFORMATION. CONTRACTOR SHALL GROUT UNDER CROSSOVER PLATFORMS AS REQUIRED TO PROVIDE A LEVEL BEARING SURFACE.

3/8"=1'-0" 12" 0 1 2 4'

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.
William D. Leadbetter 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.
Richard A. Egan 4/9/13

STATE OF MARYLAND — RICHARD A. EGAN — NO. 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/9/13
STATE OF MARYLAND — WILLIAM D. LEADBETTER — NO. 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	LBC	APPROVED 4-4-13 DATE	GRAD.
DRAFTED	KJO		PAV.
CHECKED	WGL	G. L. Amm DIRECTOR OF PUBLIC WORKS	SD
			W & S
			SWM
			OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – PLAN

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWINGS WTP-45		6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 23 OF 46
DRAWING NUMBER S642

RECORD DRAWINGS

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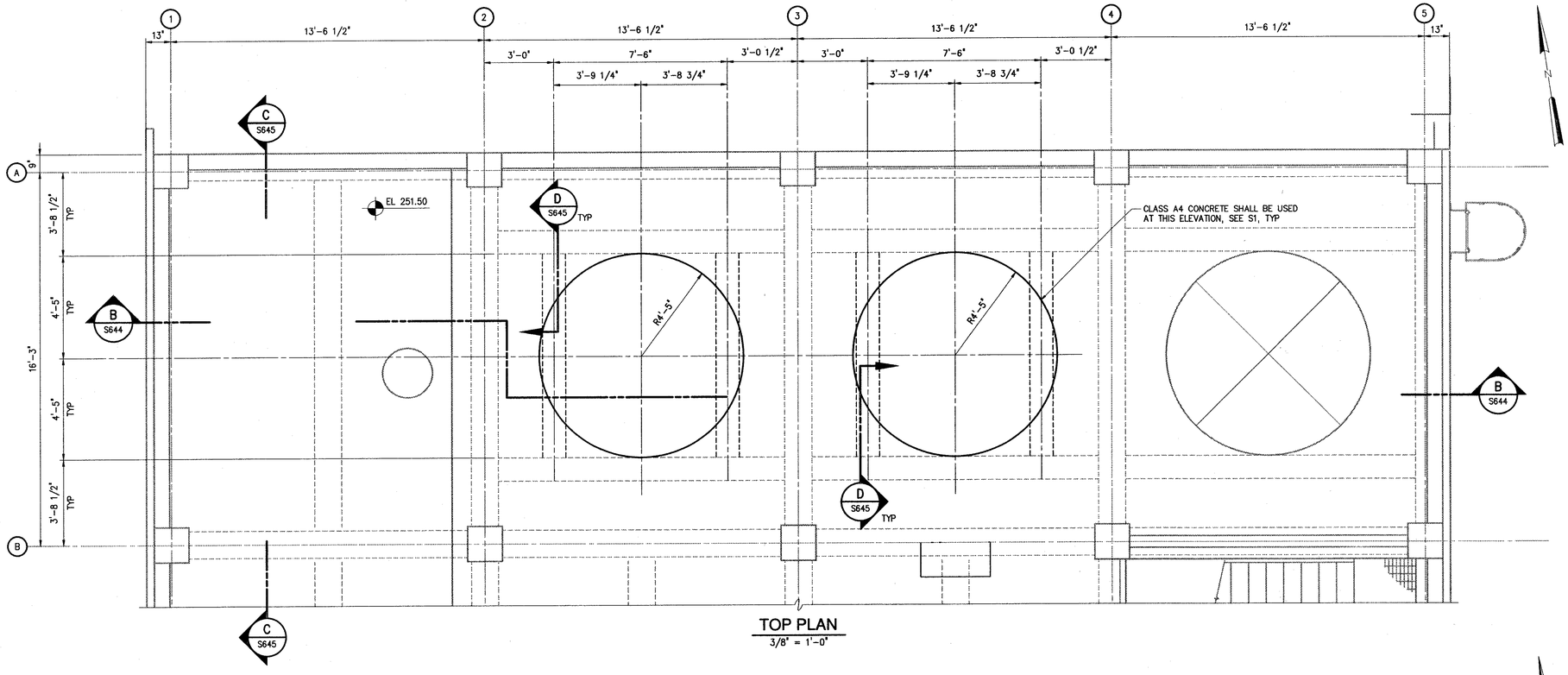
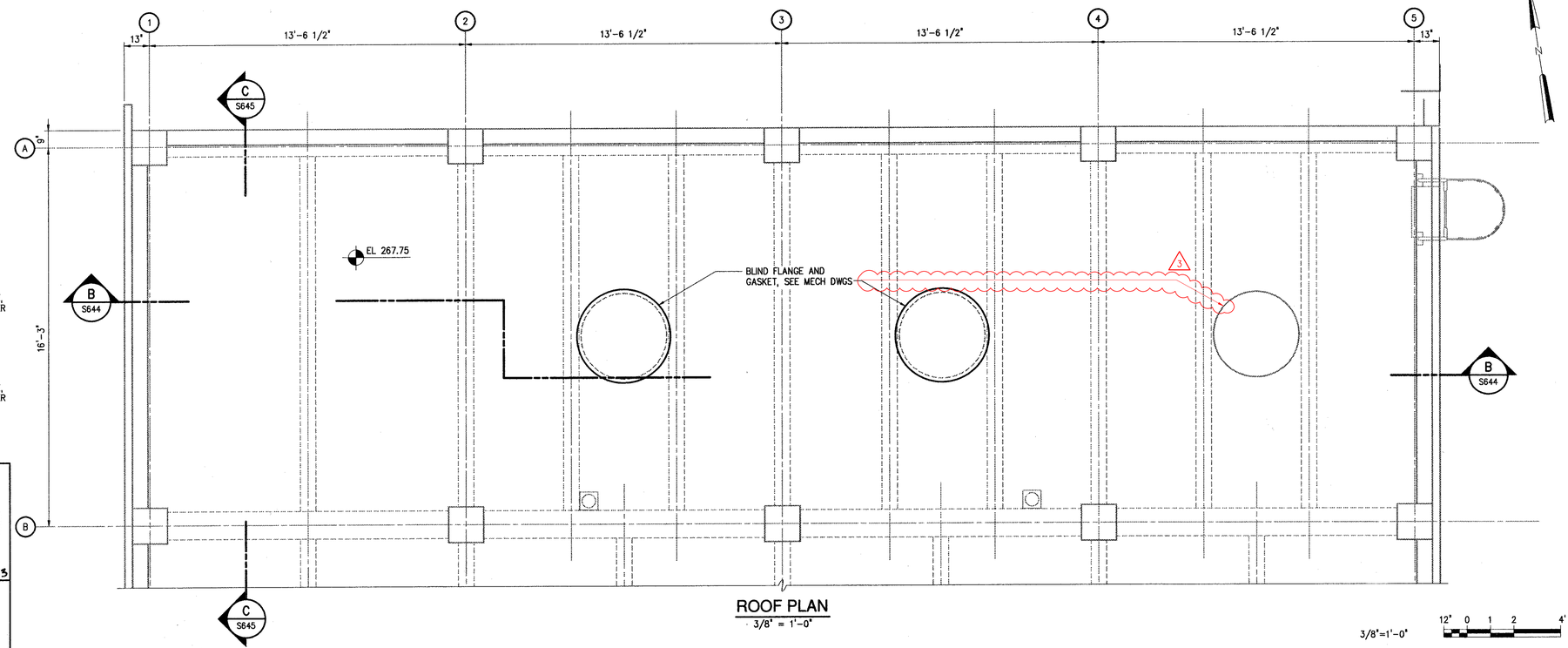
NOTES:

1. ROOF OPENING LOCATIONS AND SIZES SHALL BE FIELD VERIFIED.



TOP PLAN
3/8" = 1'-0"



ROOF PLAN
3/8" = 1'-0"

3/8"=1'-0"

12' 0 1 2 4'

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

William D. VanMatt 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

Michael S. Hagan 4/4/13

STATE OF MARYLAND — MICHAEL S. HAGAN — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/4/13

STATE OF MARYLAND — WILLIAM D. VANMATT — 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	LBC	APPROVED	4-4-13 (DATE)
DRAFTED	KJO		
CHECKED	WGL		DIRECTOR OF PUBLIC WORKS

GRAD. ____ PAV. ____ SD ____ W & S ____ SWM ____ OTHER ____

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED ____
DATE PROJECT COMPLETED ____
DATE ACCEPTED BY CITY ____
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM ____

AS BUILT COMPLETED ____ DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – PLANS

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWING	WTP-HS	6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

DATE: FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 24 OF 46
DRAWING NUMBER: S643

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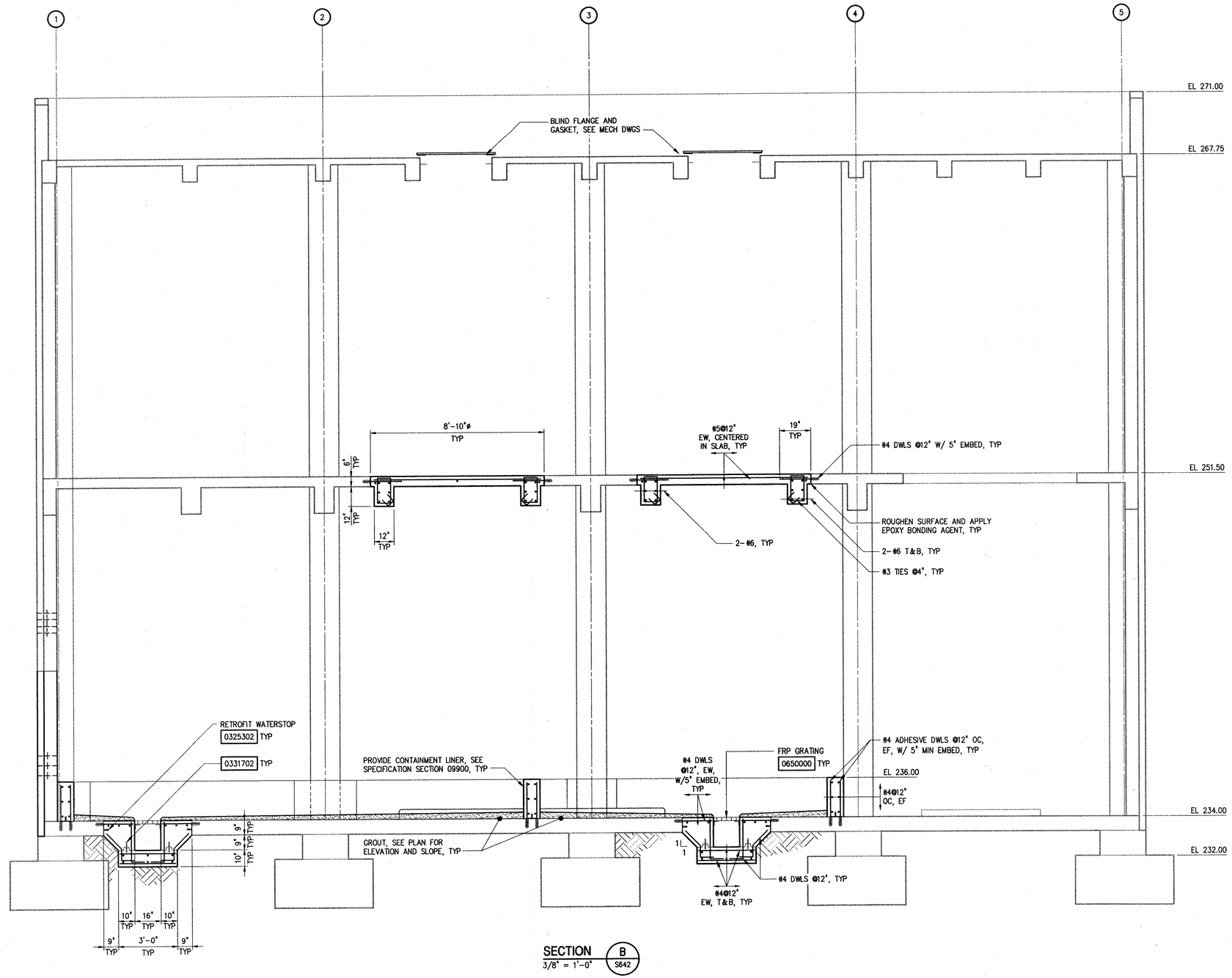
865 of 921



SECTION B
3/8" = 1'-0" S642

3/8"=1'-0"

12" 0 1 2 4'

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

William D. Lindloff 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

Andrew D. Dwyer 4/4/13

STATE OF MARYLAND — ANDREW DAVID DWYER — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/4/13

STATE OF MARYLAND — WILLIAM D. LINDLOFF — 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

NO.	REVISIONS	APP'D	DATE
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013
3	RECORD DRAWINGS		6/30/17

WTP-45

DESIGNED	LBC	APPROVED	4-4-13 DATE
DRAFTED	KJO		G. L. Amm DIRECTOR OF PUBLIC WORKS
CHECKED	WGL	GRAD.	
		PAV.	
		SD	
		W & S	
		SWM	
		OTHER	

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – SECTIONS

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 25 OF 46
DRAWING NUMBER S644

RECORD DRAWINGS

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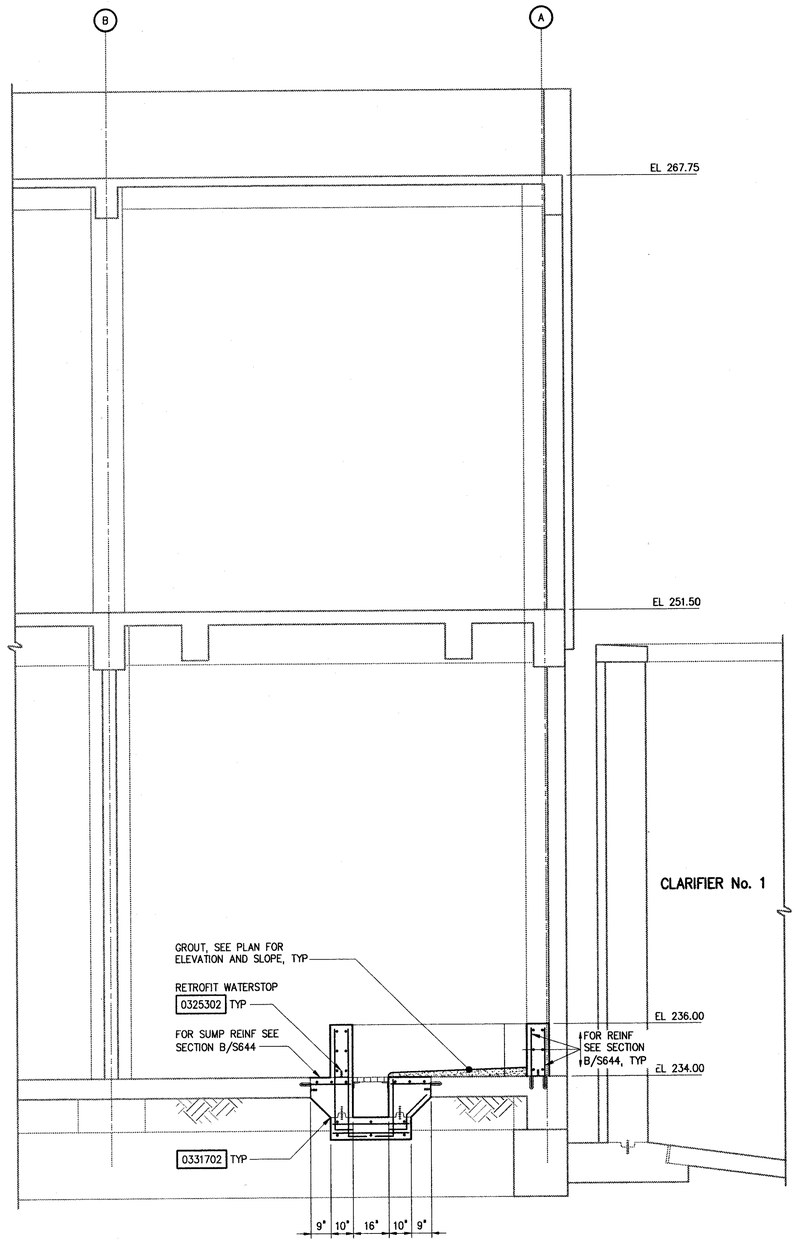
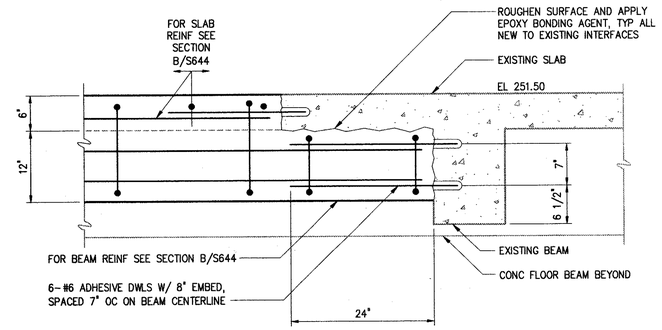


SECTION C
3/8" = 1'-0"



NEW BEAM TO EXISTING BEAM
SECTION D
1" = 1'-0"
S643

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36927, EXPIRATION DATE MARCH 27, 2015.

William D. Lawhon 3/26/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

Richard L. Lynn 4/2/13

STATE OF MARYLAND — RICHARD L. LYNN — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — WILLIAM D. LAWHON — 36927 — REGISTERED PROFESSIONAL ENGINEER — 3/26/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	LBC	APPROVED 4-4-13 DATE	GRAD.
DRAFTED	KJO		P.AV.
CHECKED	WGL	DIRECTOR OF PUBLIC WORKS	SD
			W & S
			SWM
			OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

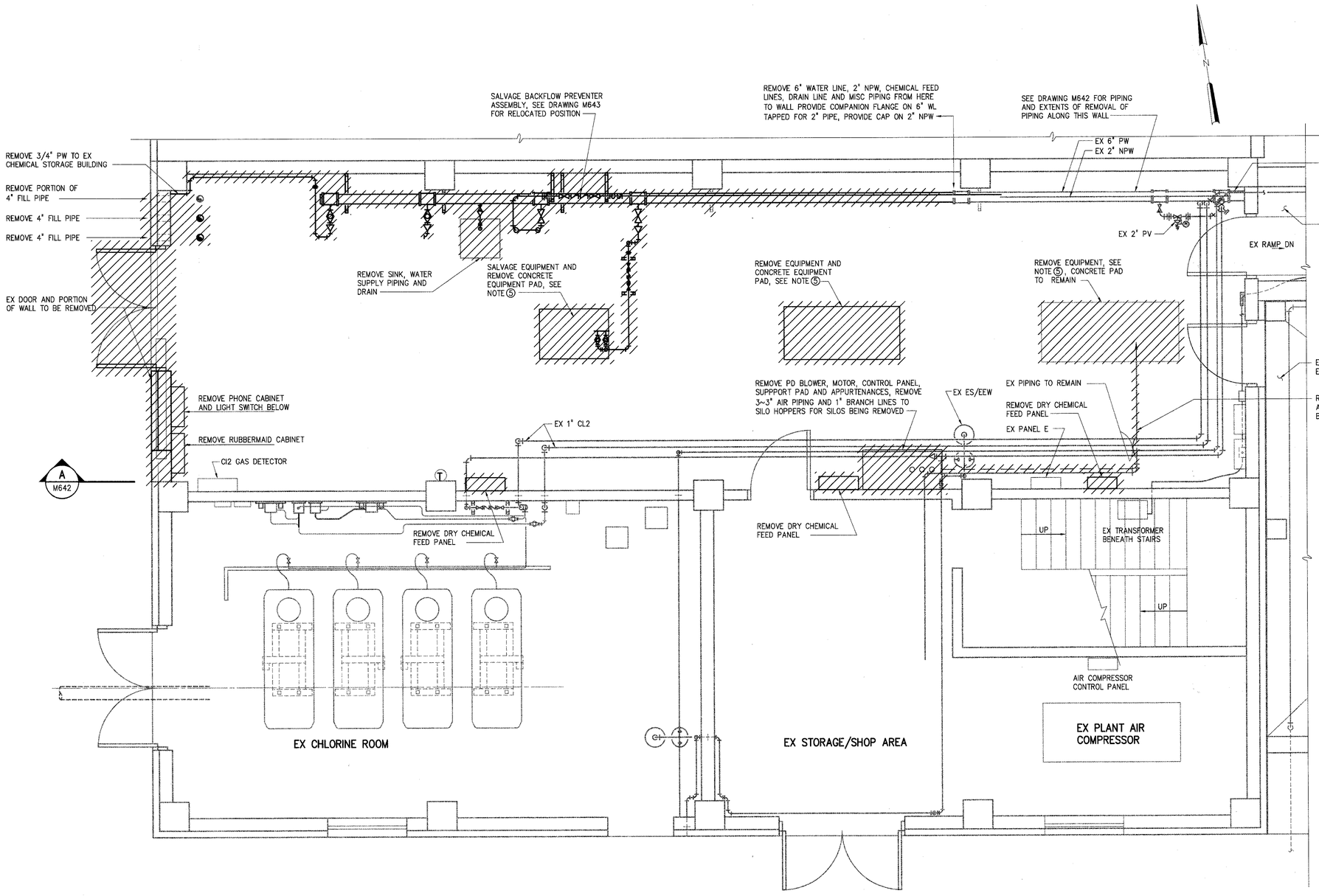
ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
STRUCTURAL
CHEMICAL BUILDING – SECTIONS AND DETAILS

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 26 OF 46
DRAWING NUMBER S645

1"=1'-0" 12" 6 0 1'
3/8"=1'-0" 12" 0 1 2 4'

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWINGS WTP-45		6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

RECORD DRAWINGS



BOTTOM PLAN
3/8" = 1'-0"

NOTES:

GENERAL NOTES:

① WHERE ITEM REMOVAL IS INDICATED ON THE DRAWING, THE REMOVAL SHALL INCLUDE THE ITEM, ITS SUPPORTS, EQUIPMENT PADS, ALL APPURTENANCES, AND ASSOCIATED CONDUIT AND WIRE.

② ELECTRICAL DEMOLITION SHALL INCLUDE THE REMOVAL AND DISPOSAL OF ALL POWER AND CONTROL CONDUIT AND WIRING BACK TO ITS SOURCE. CIRCUIT BREAKERS ASSOCIATED WITH THESE REMOVALS SHALL BE LEFT IN PLACE AND RE-LABELED AS "SPARE". OPENINGS IN ELECTRICAL EQUIPMENT RESULTING FROM THE REMOVAL OF CONDUIT AND WIRING SHALL BE IMMEDIATELY PLUGGED AND SEALED. PRIOR TO DEMOLITION, THE CONTRACTOR SHALL VERIFY THAT REMOVAL OF CONDUIT AND WIRING INDICATED ON DRAWINGS WILL NOT ADVERSELY AFFECT THE OPERATION OF ADJACENT EQUIPMENT OR PROCESSES NOT IN THIS CONTRACT. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY OF ANY SUCH CONFLICTS.

③ CHEMICAL REMOVAL AND OFF SITE DISPOSAL AT A PROPER FACILITY SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

④ PROVIDE CAPS ON ALL OPEN ENDS OF CUT PIPES TO REMAIN IN SERVICE.

⑤ SEE DRAWING M642 FOR LIMITS OF SALVAGED PAC FEED EQUIPMENT AND LIMITS OF DEMOLITION OF SILOS AND REMAINING EQUIPMENT.

DEMOLITION NOTES:

1D REFER TO SPECIFICATION SECTION 01520 FOR DETAILED CONSTRUCTION SEQUENCING REQUIREMENTS.

2D DURING DEMOLITION OF EXISTING PAC SYSTEM, CONTRACTOR SHALL TAKE CARE NOT TO DAMAGE THE EXISTING PAC SYSTEM UNITS. DAMAGED UNITS SHALL BE REPLACED BY THE CONTRACTOR AT NO COST TO THE OWNER.

3D REPAIR ALL CONCRETE DAMAGED DURING DEMOLITION OPERATIONS. THE CONTRACTOR SHALL GUARANTEE ALL REPAIR WORK AGAINST DEFECTS IN WORKMANSHIP (INCLUDING FAILURE OF CONCRETE BOND) FOR A PERIOD OF 2 YEARS FROM THE DATE OF THE CERTIFICATE OF SUBSTANTIAL COMPLETION. THE CONTRACTOR SHALL SUBMIT TECHNICAL DATA ON ALL REPAIR MATERIALS FOR APPROVAL. THE SUBCONTRACTOR/APPLICATOR SHALL SUBMIT A LETTER FROM THE MANUFACTURER STATING THAT HE IS ON THE MANUFACTURER'S APPROVED LIST OF CONTRACTORS.

4D WHERE DEMOLITION EXPOSES REINFORCING STEEL OR BOLTS IN CONCRETE THAT WILL NOT BE SUBSEQUENTLY COVERED BY NEW CONSTRUCTION, REINFORCEMENT SHALL BE BURNED BACK 1 1/2" AND PATCHED WITH EPOXY RESIN BINDER PER SPECIFICATION SECTION 03250.

5D CONTRACTOR SHALL BREAKDOWN DEMOLISHED EQUIPMENT PIECES THAT WILL FIT THROUGH EXISTING DOORS. ANY DAMAGE TO EXISTING WALLS, DOORS, ETC SHALL BE REPAIRED TO ORIGINAL CONDITION BY CONTRACTOR.

6D CONTRACTOR SHALL REMOVE UNIT HEATERS AND ASSOCIATED PIPING AS INDICATED ON M642. PIPING FOR EXISTING HEATERS TO REMAIN SHALL BE RECONNECTED AND UNIT HEATERS AND SYSTEM PIPING SHALL BE RETURNED TO OPERATING CONDITION.

7D ALL ROOMS CONTAINING EXISTING LIME OR PAC EQUIPMENT SHALL BE CLEANED TO "LIKE NEW" CONDITIONS.

3/8"=1'-0" 12" 0 1 2 4'

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWING WTP-45		10/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 32187, EXPIRATION DATE AUGUST 18, 2013.
4/2/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.
4/2/13

STATE OF MARYLAND — CHRISTOPHER A. SEGON — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13
STATE OF MARYLAND — ANDREW W. DEBUS II — 32187 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	CAS	GRAD.	
DRAFTED	CAS	PAV.	
CHECKED	AWD	SD	
		W & S	
		SWM	
		OTHER	

APPROVED 4-4-13 DATE
DIRECTOR OF PUBLIC WORKS

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT.. W/R 9 FORM

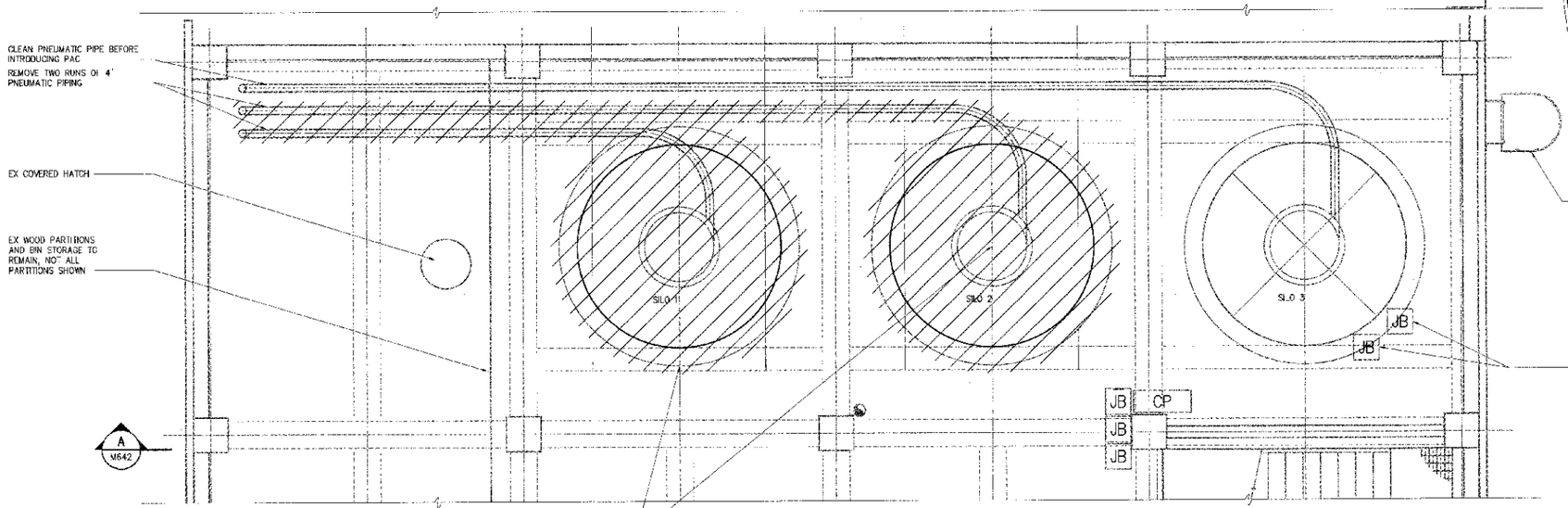
AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
MECHANICAL
CHEMICAL BUILDING BOTTOM PLAN – DEMOLITION

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 11 OF 46
DRAWING NUMBER M640

RECORD DRAWINGS

EXISTING CLARIFIER No. 1

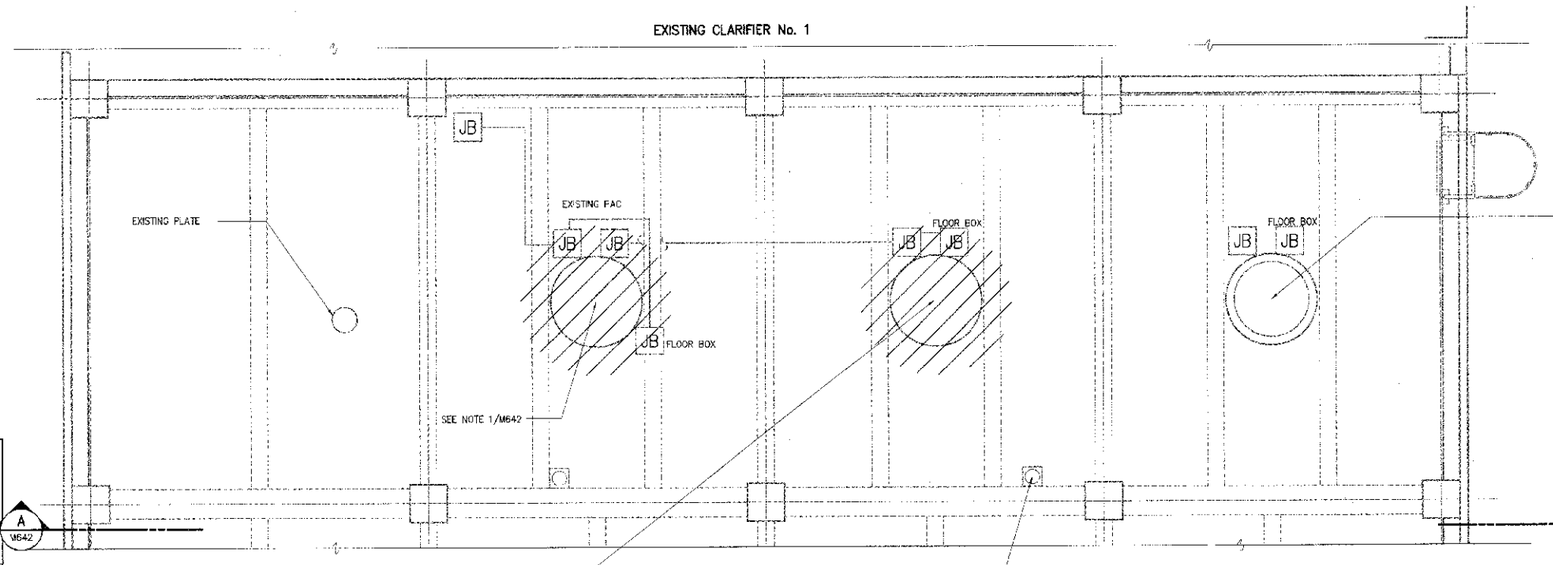


TOP PLAN
3/8" = 1'-0"

NOTES:

1. SEE STRUCTURAL DRAWINGS FOR FLOOR REPAIRS.
2. CONTRACTOR SHALL REMOVE CONTENTS OF THE EXISTING BULK LIME SILO (SILO 3) AND PROPERLY DISPOSE OFF SITE. EMPTY SILO SHALL BE THOROUGHLY CLEANED, DRIED AND INSPECTED PRIOR TO ADDITION OF PAC.
3. WORK ON SILOS 1 AND 2 SHALL NOT COMMENCE UNTIL THE CONTENTS OF SILO 1 ARE TRANSFERRED TO SILO 3 AND THE NEW PAC SYSTEM IS PLACED IN WORKING ORDER. REFER TO SECTION 01520 FOR DETAILED SEQUENCING REQUIREMENTS.
4. CONTRACTOR SHALL TAKE CARE NOT TO DAMAGE THE ROOF MEMBRANE AROUND THE ROOF PENETRATIONS OR THE BOTTOM MOUNTING FLANGE OF THE DUST COLLECTORS.
5. CONTENTS OF SILOS, DUST COLLECTORS, FEEDERS AND OTHER ITEMS TO BE REMOVED SHALL BE COLLECTED AND DISPOSED OF PER GOVERNING REGULATIONS.

EXISTING CLARIFIER No. 1



ROOF PLAN
3/8" = 1'-0"

3/8"=1'-0"

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4/2/13

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4/2/13

STATE OF MARYLAND — EDWARD A. HANLON — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — ANDREW W. DEBUS II — 32187 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
1035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

DESIGNED	EJR	APPROVED 4-4-13 DATE	GRAD.
DRAFTED	CAS		PAV.
CHECKED	AWD		SD
		DIRECTOR OF PUBLIC WORKS	W & S
			SWM
			OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT. W/R 9 FORM

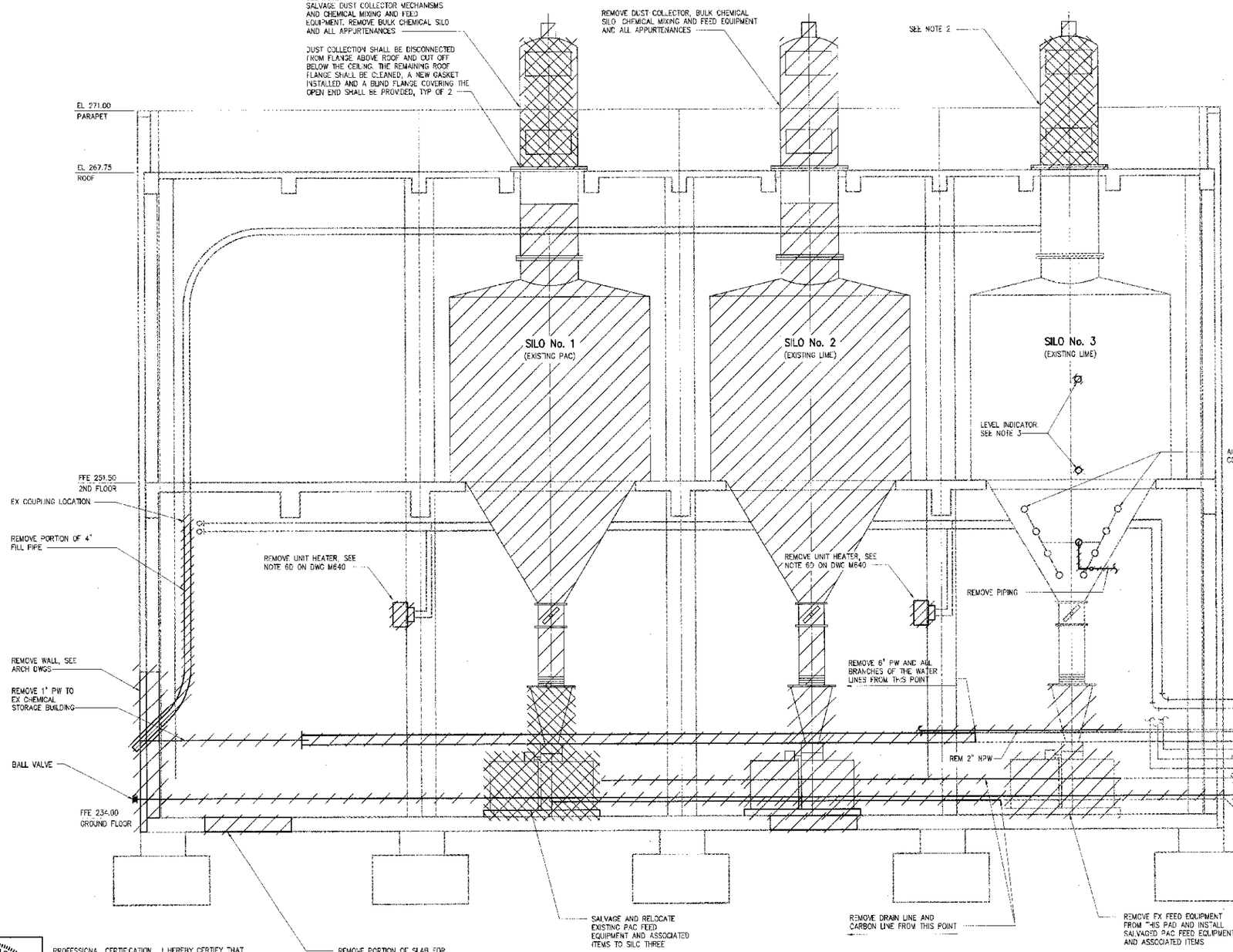
AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
MECHANICAL
CHEMICAL BUILDING TOP PLAN – DEMOLITION

NO.	REVISIONS	APP'D	DATE
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013
3	RECORD DRAWING WTP 45		5/30/17

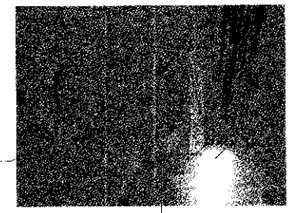
DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4440 & 1034)
SHEET NO. 12 OF 46
DRAWING NUMBER M641

RECORD DRAWINGS



NOTES:

1. SALVAGE UNIT INTERNAL MOTOR AND MECHANISMS FOR REUSE, REMOVE HOUSING.
2. REHABILITATE, CLEAN AND REPAINT HOUSING. EXISTING HOUSING PAINT SHALL BE STRIPPED USING "LEAD-OUT PAINT STRIPPER" AS MANUFACTURED BY SOLUCORP OR EQUAL. LEAD TESTING OF STRIPPED PAINT SHALL BE CONDUCTED PRIOR TO PAINT DISPOSAL. PROPER DISPOSAL OF ALL PAINT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR. REMOVE EXISTING INTERNAL MECHANISMS AND INSTALL SALVAGED MECHANISMS FROM THE PAC SILO DUST COLLECTOR.
3. REMOVE LEVEL INDICATORS AND GASKETS. CONDUIT AND WIRING TO REMAIN.



SECTION A
3/8" = 1'-0" M640

3/8"=1'-0"

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 32187, EXPIRATION DATE AUGUST 18, 2013.

4/2/13

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4/2/13

STATE OF MARYLAND — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — CERTIFIED PROFESSIONAL ENGINEER — 4/2/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

NO.	REVISIONS	APP'D	DATE
	ISSUED FOR PERMITTING	AWD	2/20'13
	ISSUED FOR BIDDING	AWD	3/20'13
3	RECORD DRAWING		6/30/17

WTP-115

DESIGNED EJR
DRAFTED CAS
CHECKED AWD

APPROVED 4-4-13 DATE
DIRECTOR OF PUBLIC WORKS

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W & S
SWM
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DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
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DATE TRANS. TO FINANCE DEPT. W/R'S FORM

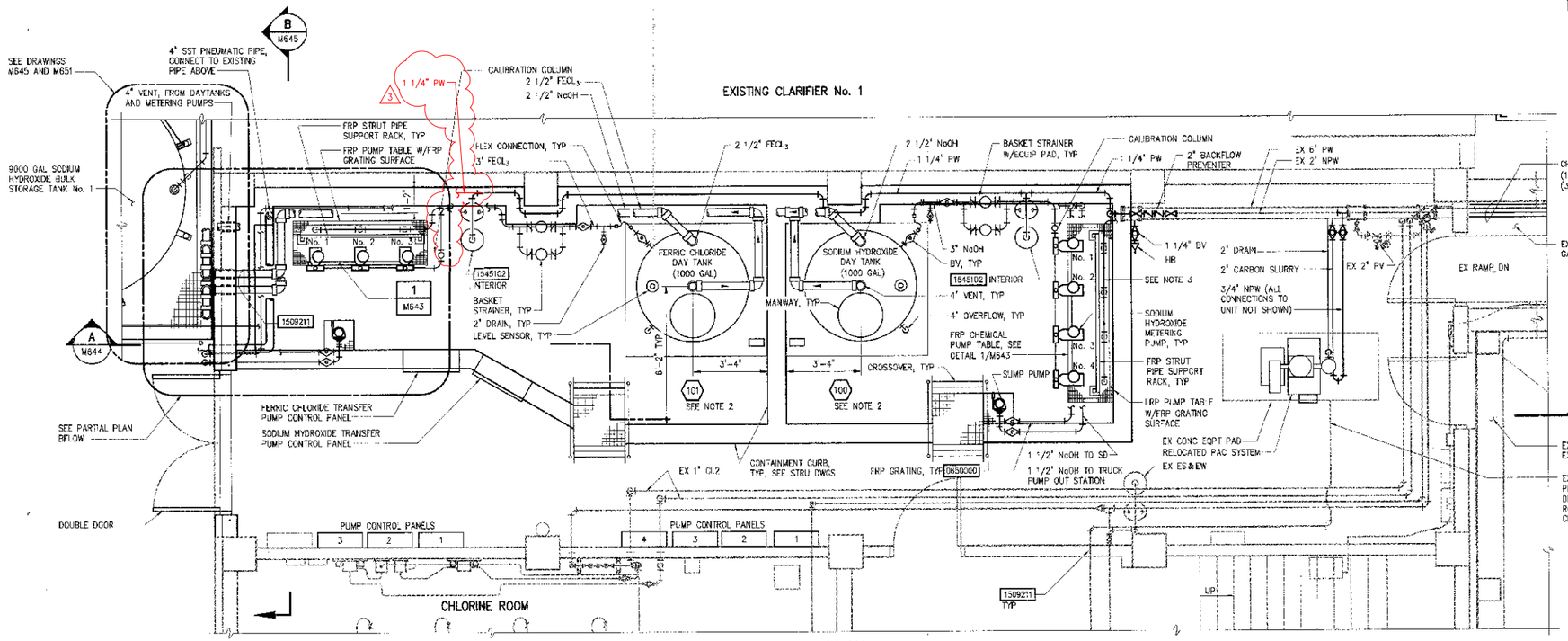
AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT

MECHANICAL
CHEMICAL BUILDING – SECTION – DEMOLITION

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4440 & 1C34)
SHEET NO. 13 OF 46
DRAWING NUMBER M642

RECORD DRAWINGS

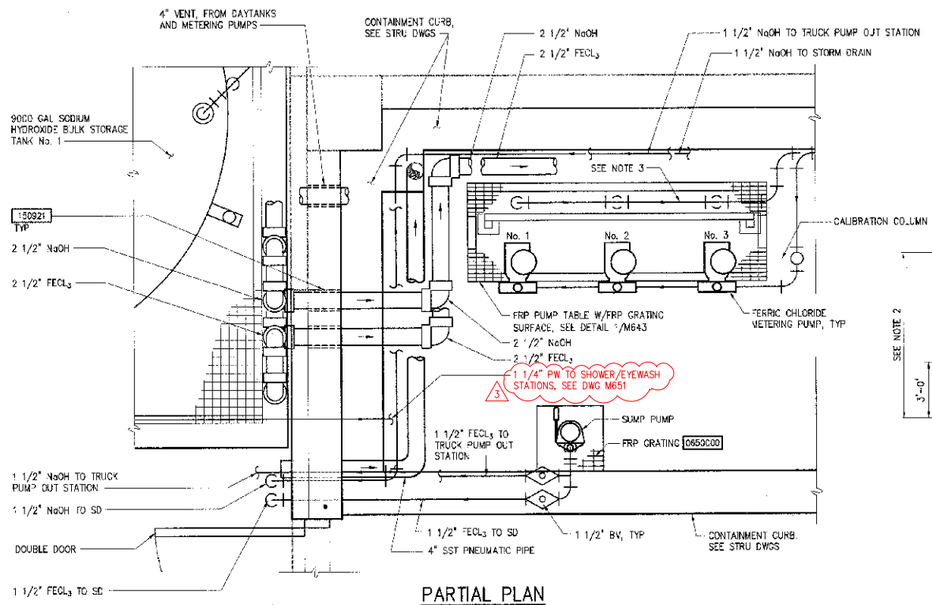


PLAN
3/8" = 1'-0"

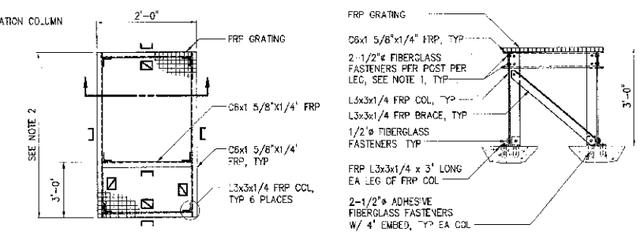
NOTES:

1. SEE THE CHEMICAL SCHEMATICS FOR PIPING, VALVE AND OTHER REQUIREMENTS OF THE CHEMICAL FEED SYSTEM.
2. SEE DRAWING A640 FOR CONTAINMENT COATING REQUIREMENTS.
3. METERING PUMP DISCHARGE LINES AND APPURTENANCES SHALL BE PROVIDED ON FRP RACK. SEE SCHEMATIC FOR PIPING DETAILS.

CHEMICAL SUMP PUMP SCHEMATIC
1514500R



PARTIAL PLAN
3/4"=1'-0"



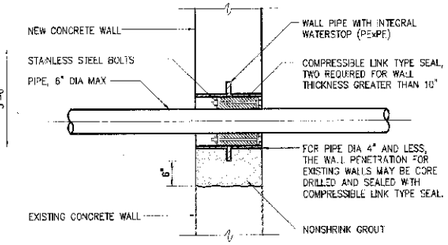
PLAN

SECTION

NOTE:
1. SEE SPECIFICATION SECTION 05610, GLASS FIBER AND RESIN APPLICATIONS, FOR REQUIREMENTS OF FRP GRATING, STRUCTURAL SHAPES AND BOLTED CONNECTIONS.
2. FRP TABLE TYPE 1 SHALL BE 6'-0" LONG. FRP TABLE TYPE 2 SHALL BE 8'-0" LONG. REGARDLESS OF TABLE LENGTH VERTICAL BRACING SHALL BE THE SAME.
3. ☒ DENOTES VERTICAL CROSS BRACING LOCATION, SEE SECTION.

FRP CHEMICAL PUMP TABLE

DETAIL	1
NTS	M643



1509211

NOTE: DETAIL MAY BE MODIFIED WITH ENGINEERS APPROVAL TO MATCH FIELD CONDITIONS. POSSIBLE MODIFICATIONS INCLUDE DELETING THE WALL SLEEVE OR CORE DRILLING IN EXISTING WALLS. SLEEVE WITH WATERSTOP SHALL ALWAYS BE USED IN NEW WALL CONSTRUCTION.

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 32187, EXPIRATION DATE AUGUST 18, 2013.

4/2/13

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 22307, EXPIRATION DATE APRIL 9, 2015.

4/2/13

STATE OF MARYLAND — RICHARD S. LYON — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — EDWARD J. HARRIS — 32187 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4055 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

3	RECORD DRAWING	WTP-45		6/30/17
2	ISSUED FOR BIDDING		AWD	3/2013
1	ISSUED FOR PERMITTING		AWD	2/2013
NO.	REVISIONS		APP'D	DATE

DESIGNED EJR
DRAFTED CAS
CHECKED AWD

APPROVED 4-4-13 DATE
DIRECTOR OF PUBLIC WORKS

GRAD. ___
PAV. ___
SD ___
W & S ___
SWM ___
OTHER ___

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT. W/R & P FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
MECHANICAL
CHEMICAL BUILDING – BOTTOM PLAN – MODIFIED

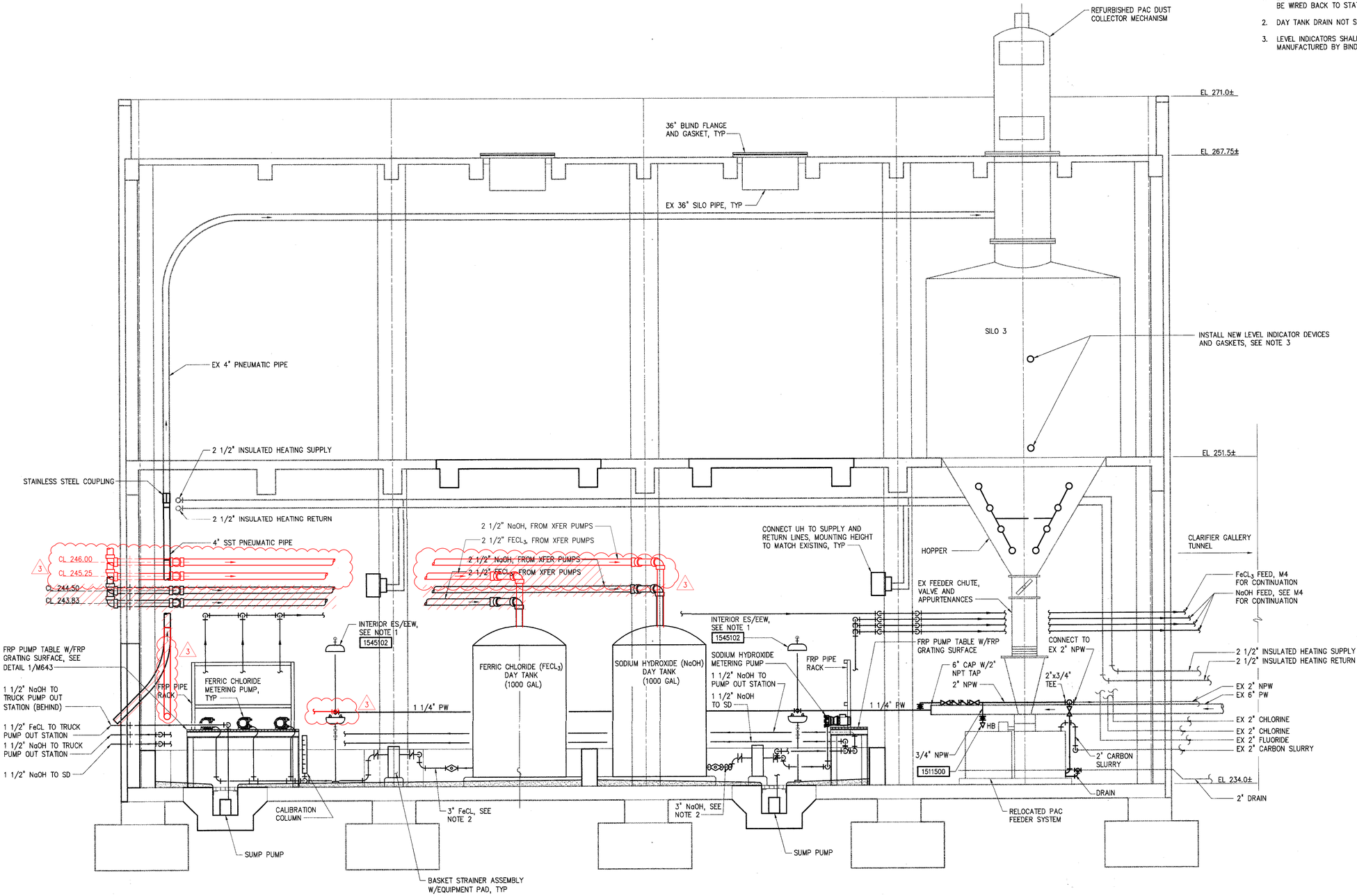
DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4440 & 1034)
SHEET NO. 14 OF 46
DRAWING NUMBER M643

3/4"=1'-0" 6' 0 1 2'
3/8"=1'-0" 12" 0 1 2 4'

RECORD DRAWINGS

NOTES:

1. EMERGENCY SHOWER AND EYEWASH EYEWASH, STATUS SIGNALS SHALL BE WIRED BACK TO STATUS PANEL IN THE CONTROL ROOM.
2. DAY TANK DRAIN NOT SHOWN FOR CLARITY, SEE DWG M643.
3. LEVEL INDICATORS SHALL BE ROTO-BIN-DICATOR MODEL R AS MANUFACTURED BY BINDICATOR OR EQUAL.



SECTION A
3/8" = 1'-0" M643

3/8"=1'-0"

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4/2/13

STATE OF MARYLAND — ANDREW W. JOHNSON — 22307 — REGISTERED PROFESSIONAL ENGINEER — 4/2/13

STATE OF MARYLAND — EDWARD J. REGAN — 32187 — PROFESSIONAL ENGINEER — 4/2/13

HAZEN AND SAWYER
Environmental Engineers & Scientists
4035 Ridge Top Road, Suite 400, Fairfax, Virginia 22030

NO.	REVISIONS	APP'D	DATE
3	RECORD DRAWING WTP-45		6/30/17
	ISSUED FOR BIDDING	AWD	3/2013
	ISSUED FOR PERMITTING	AWD	2/2013

DESIGNED EJR
DRAFTED CAS
CHECKED AWD

APPROVED 4-4-13 DATE
DIRECTOR OF PUBLIC WORKS

GRAD. ____
PAV. ____
SD ____
W & S ____
SWM ____
OTHER ____

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
MARYLAND AT VINSON ROCKVILLE, MARYLAND

DATE PROJECT STARTED
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AS BUILT COMPLETED ____ DATE
CHIEF INSPECTOR

ROCKVILLE WATER TREATMENT PLANT
FERRIC CHLORIDE FEED SYSTEM PROJECT
MECHANICAL
CHEMICAL BUILDING – SECTION

DATE FEB 2013
CITY JOB NO. IFB # 28-13 (CIP #4A40 & 1C34)
SHEET NO. 15 OF 46
DRAWING NUMBER M644

RECORD DRAWINGS

079 of 084

20130328 4:17P G:\D-drive\20041-hfs\20041-001\drawings\mechanical\M644.dwg LastSavedBy:DJOHNSON

CITY OF ROCKVILLE

MONTGOMERY COUNTY, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT

HUD PROJECT NO. WS-2-21-0001

CONTRACT NO. 65-310-W

BID NO. 23-67 A,B,C,D & E

APPROVED: Ward L. Pottinger, DIRECTOR OF PUBLIC WORKS

BAKER-WIBBERLEY & ASSOCIATES, INC.

CONSULTING ENGINEERS

HAGERSTOWN, MARYLAND

Edward A. Kissel 2/1/66

STATE OF MARYLAND

WTP-16

Edward A. Riehl 3/1/66

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5	MAIN BUILDING - PIPE GALLERY - SECTIONS
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33	CHEMICAL BUILDING - STRUCTURAL DETAILS - 1ST FL., FOUND. & COLUMNS
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35	CHEMICAL BUILDING - STRUCTURAL DETAILS - ROOF
36	CHEMICAL BUILDING - STRUCTURAL DETAILS - SECTIONS

HUD PROJECT NO. WS - 2 - 21 - 0001

NO.	REVISIONS	APP'D	DATE

DESIGNED
TRACED
CHECKED

APPROVED 3/14/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
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DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

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DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED
DATE
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
LOCATION PLAN AND INDEX

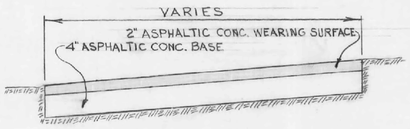
DATE DEC. 1965
JOB NO. 65-310-W

SCALE 1" = 2000'

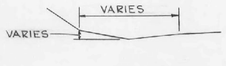
DRAWING NO. 1 OF 36

FILE WTP-1

874 of 921



DETAIL
ROAD SECTION
NO SCALE

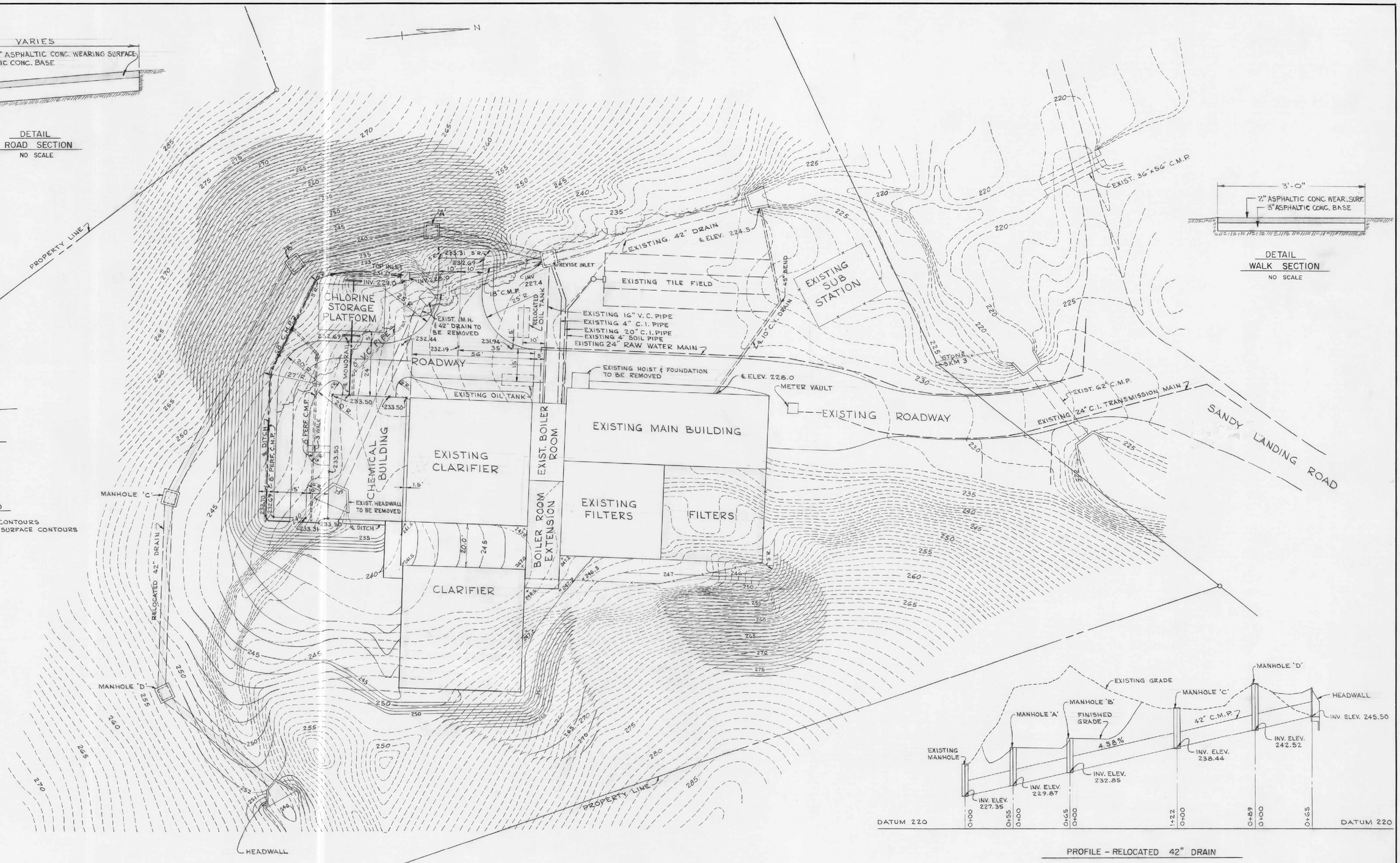


TYPICAL DITCH
NO SCALE

LEGEND

—250— EXISTING CONTOURS
—250— FINISHED SURFACE CONTOURS

DETAIL
WALK SECTION
NO SCALE



PLAN
SCALE: 1"=20'

PROFILE – RELOCATED 42" DRAIN
SCALE: HOR. 1"=50'
VERT. 1"=10'

NOTE:
B.M. STONE SKM 3 ELEV. 222.77

Edmund A. Riedel 3/1/68

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	ROAD & WALK SECTIONS		JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/14/68 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

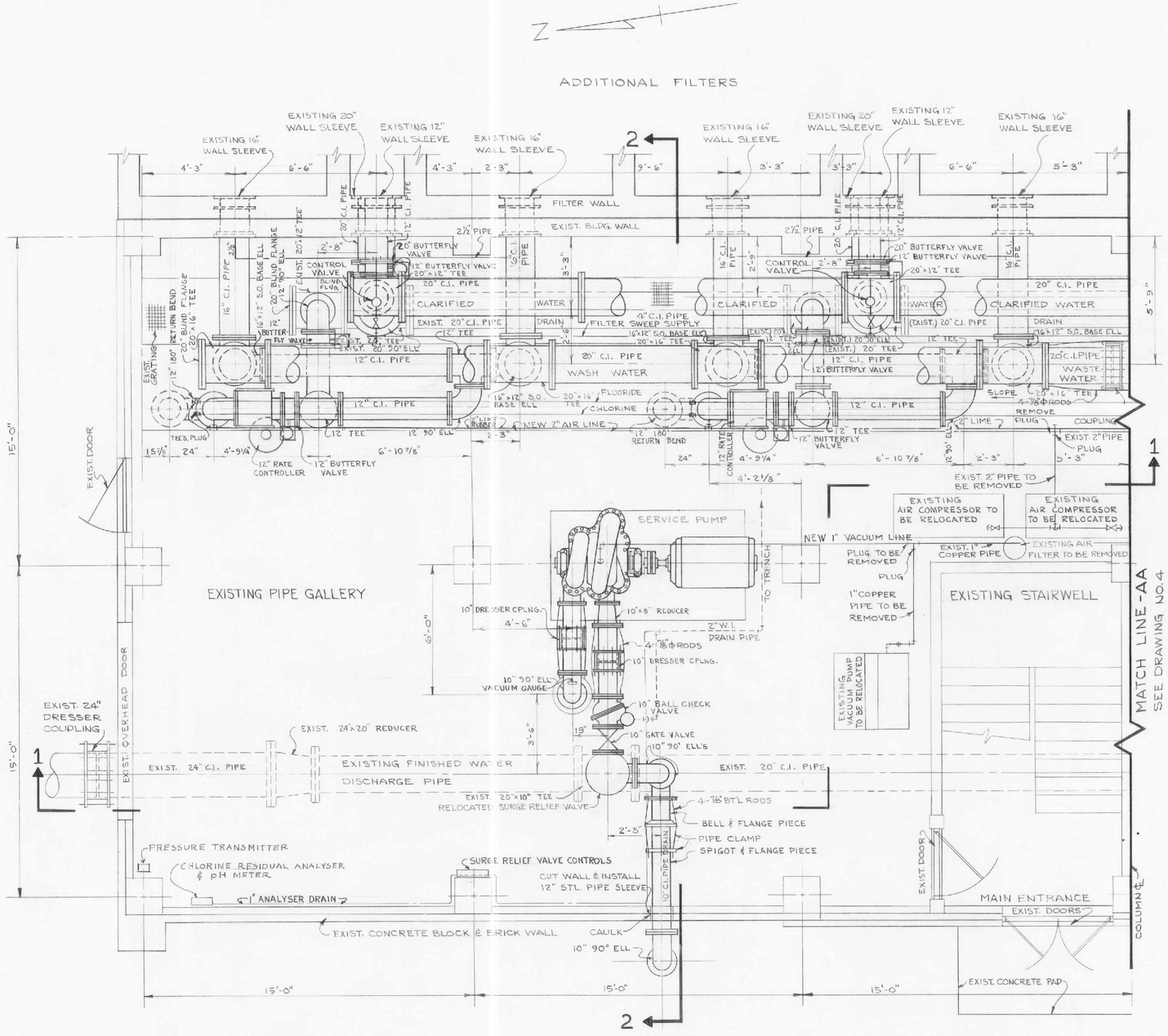
DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/4/69 DATE
William R. Moon CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

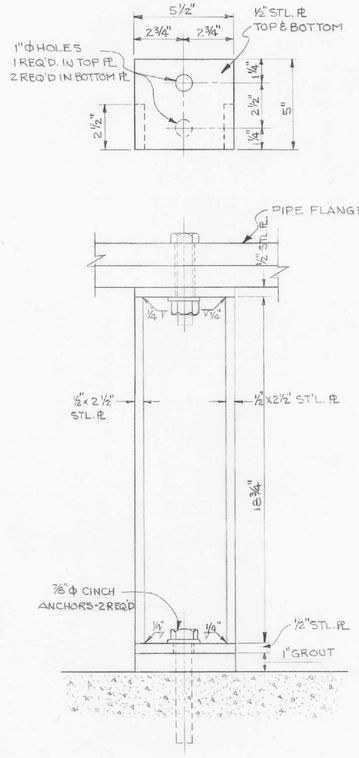
ENLARGEMENT OF WATER TREATMENT PLANT
GENERAL PLAN

DATE: DEC. 1965
JOB NO. 65-310-W
SCALE: AS SHOWN
DRAWING NO. 2 OF 36
FILE WTP-16



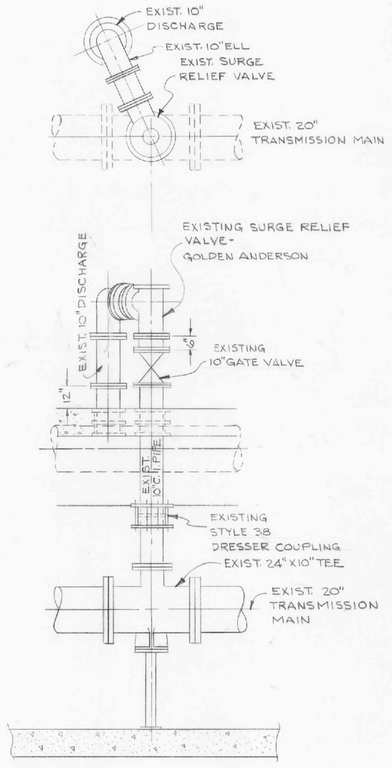
PLAN

SCALE: 3/8"=1'-0"



PIPE SUPPORT DETAIL

SCALE: 1"=1'-0"



DETAIL OF EXISTING SURGE RELIEF VALVE

SCALE: 1"=1'-0"

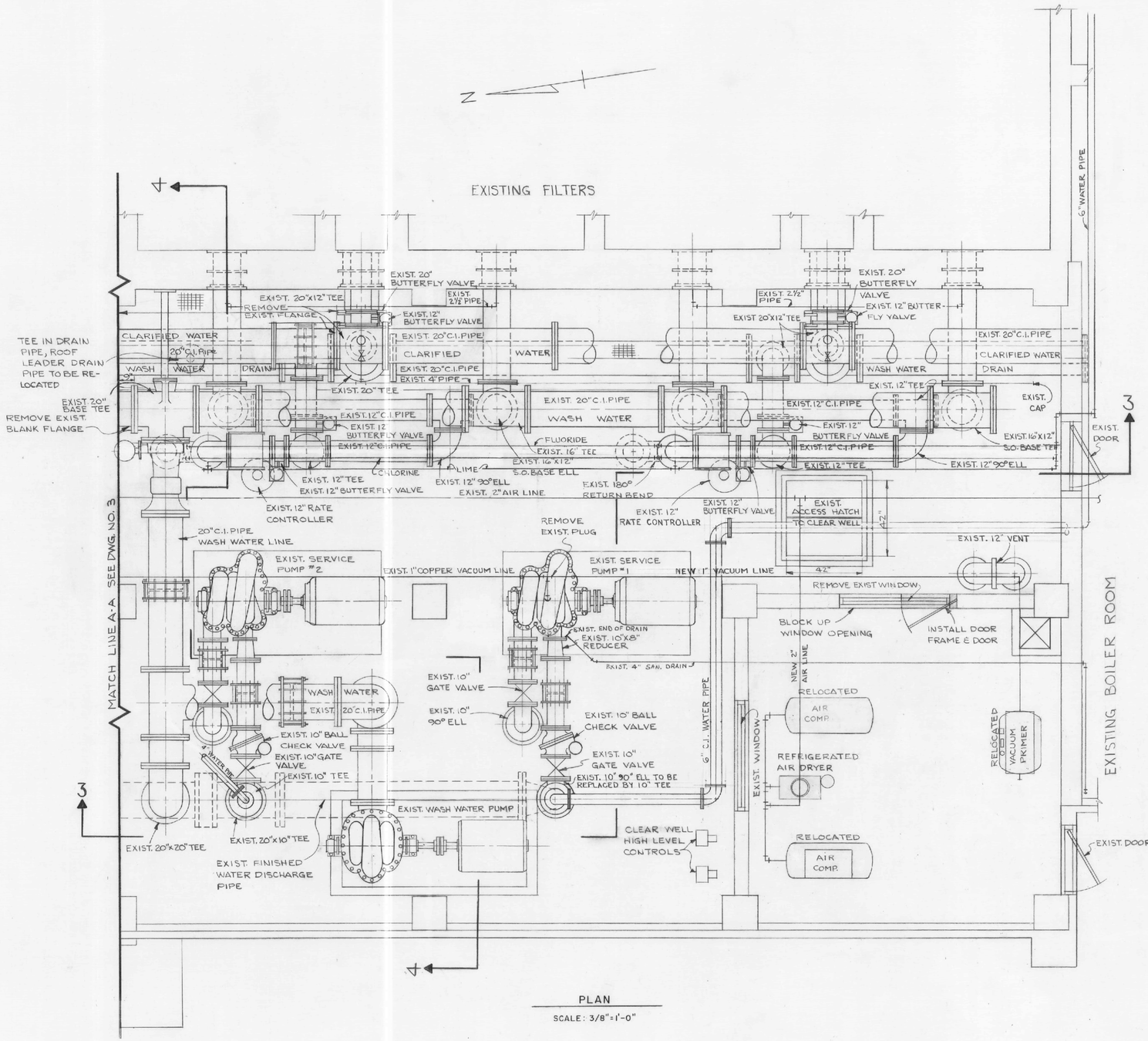
Edward A. Reid 3/1/66

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS

HUD PROJECT NO. WS-2-21-0001

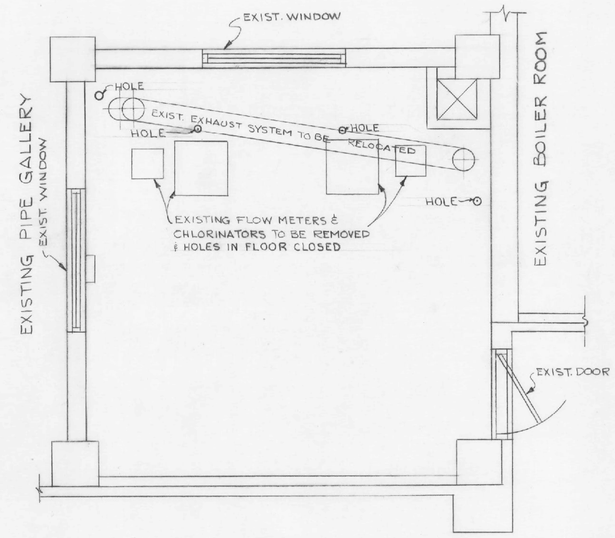
DESIGNED	APPROVED 3/1/66 DIRECTOR OF PUBLIC WORKS	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 3/4/68 DATE William R. Wood CHIEF INSPECTOR	BAKER-WIBBERLEY & ASSOCIATES, INC. CONSULTING ENGINEERS HAGERSTOWN, MARYLAND	ENLARGEMENT OF WATER TREATMENT PLANT **MAIN BUILDING-PIPE GALLERY** PLAN AND DETAILS	NO.	REVISIONS	APP'D	DATE
TRACED		PAV.		DATE PROJECT COMPLETED				DATE DEC. 1965		SCALE AS SHOWN	DRAWING NO. 3 OF 36
CHECKED		SD		DATE ACCEPTED BY CITY				JOB NO. 65-310-W			FILE WTP-16
		W		DATE TRANS. TO FINANCE DEPT., W/R & FORM							
		S									
		OTHER									

070-1-021



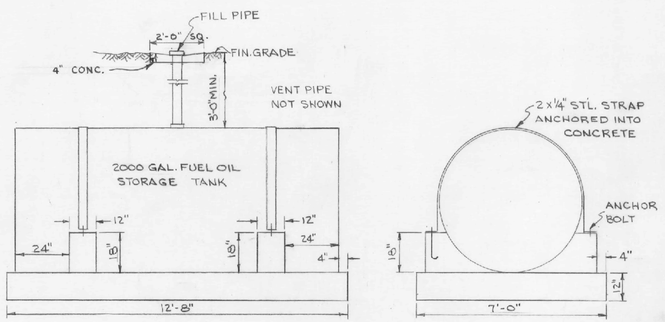
PLAN

SCALE: 3/8"=1'-0"



PLAN OF EXISTING CHLORINE ROOM

SCALE: 3/8"= 1'-0"



DETAILS

RELOCATED FUEL OIL TANK BASE

SCALE: 3/8"=1'-0"

Edward A. Riedel 9/1/66

STATE OF MARYLAND — EDWARD ALEXANDER RIEDEL — No. 3911 — REGISTERED PROFESSIONAL ENGINEER

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS [ ]

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED PLUMBING	WRK	JAN. 1967

CITY OF ROCKVILLE MARYLAND

DESIGNED
TRACED
CHECKED

APPROVED 9/1/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED 9/4/69 DATE
William R. Moon CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - PIPE GALLERY
PLANS AND DETAILS

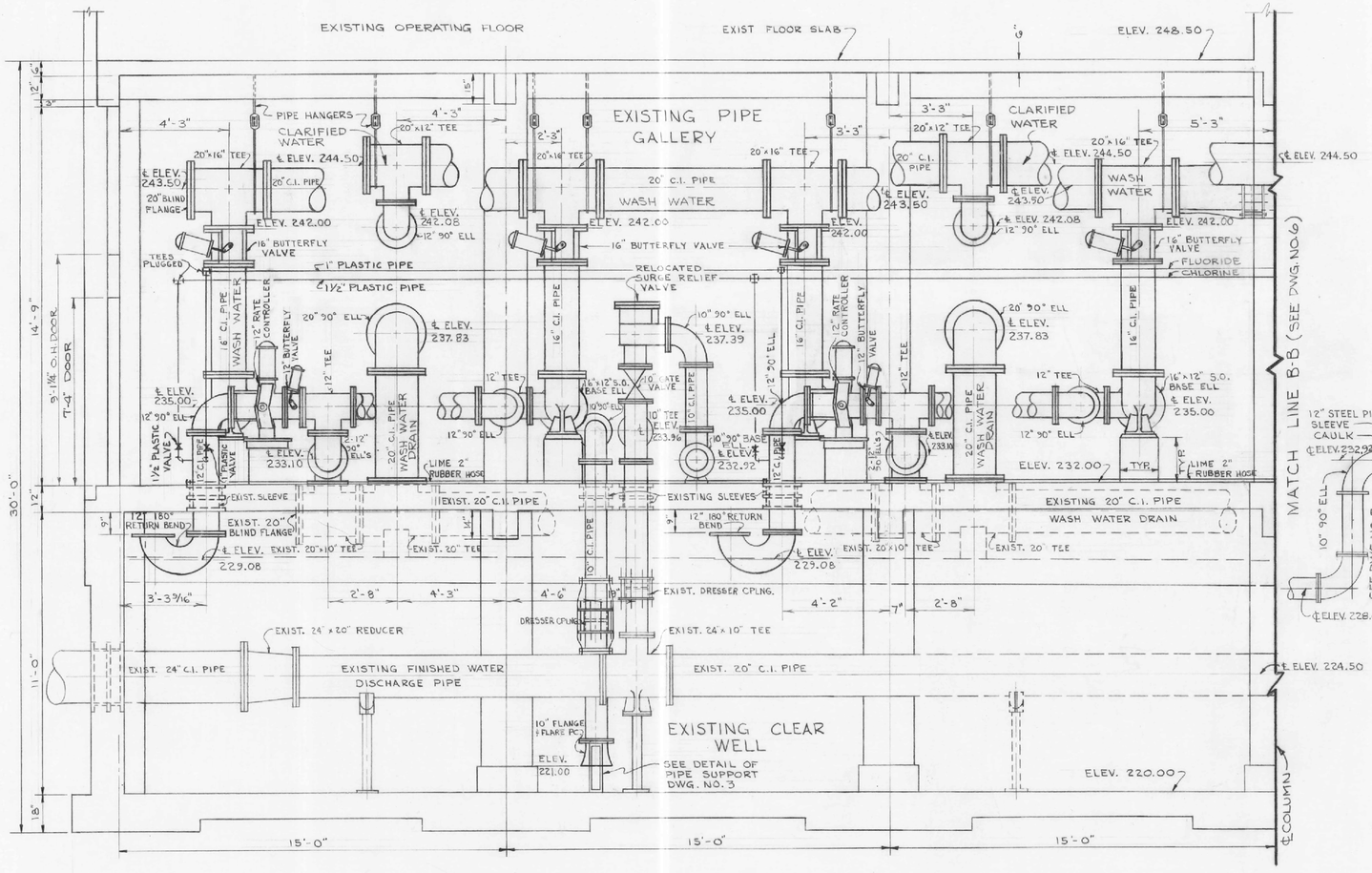
DATE DEC. 1965
JOB NO. 65-310-W

SCALE AS SHOWN

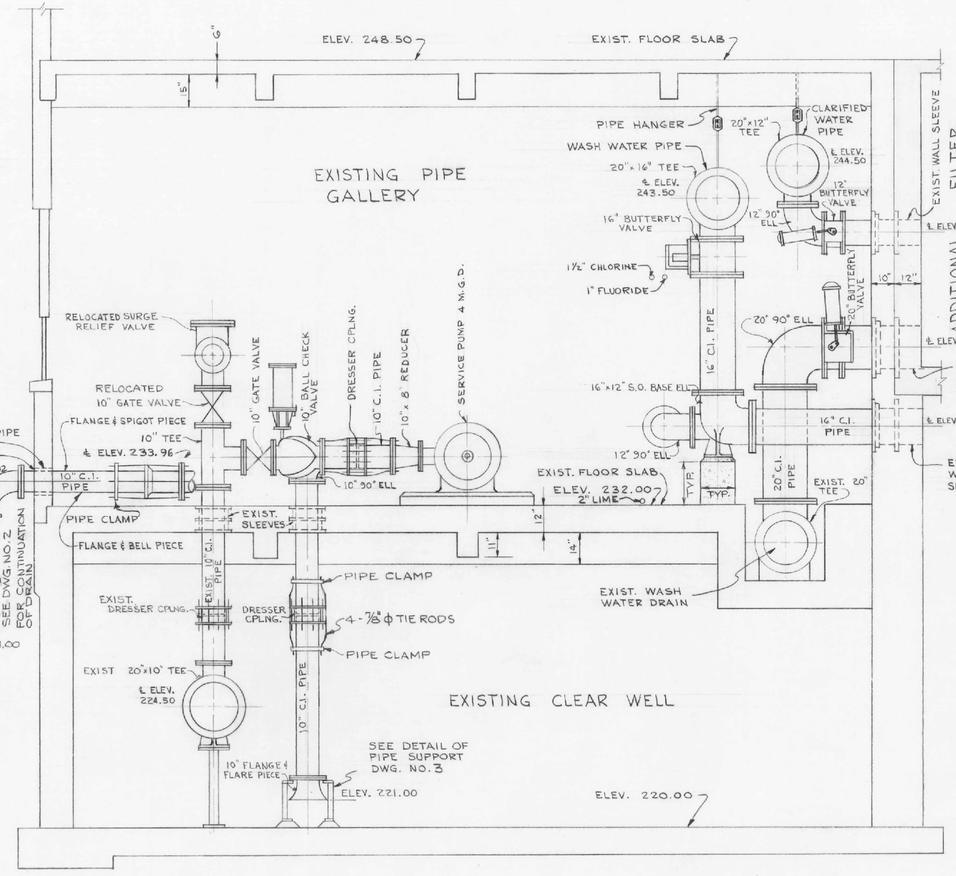
DRAWING NO. 4 OF 36

FILE WTP-1

077 of 021



SECTION 1-1



SECTION 2-2

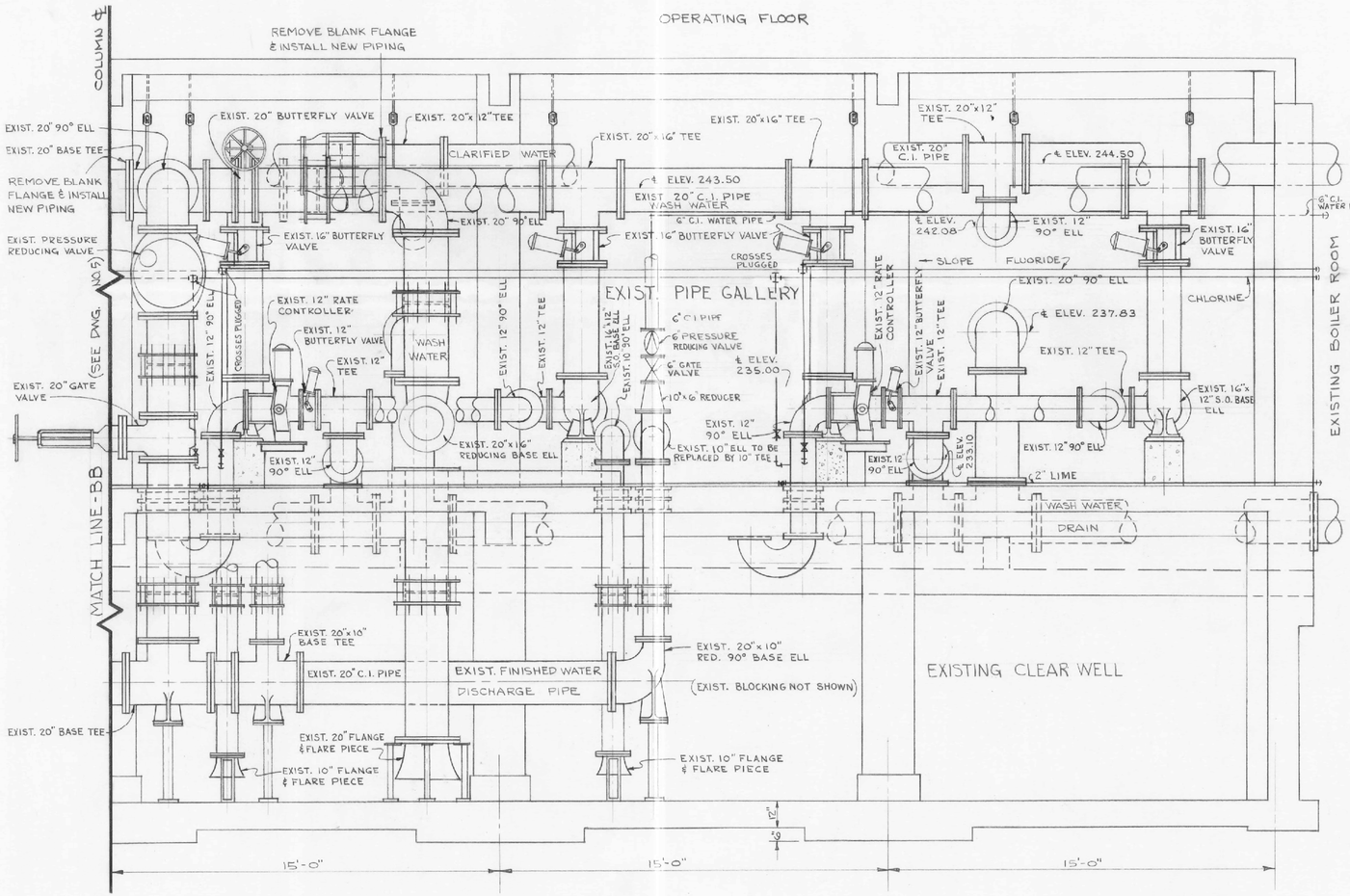
Edward A. Kaelin 3/1/68

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS

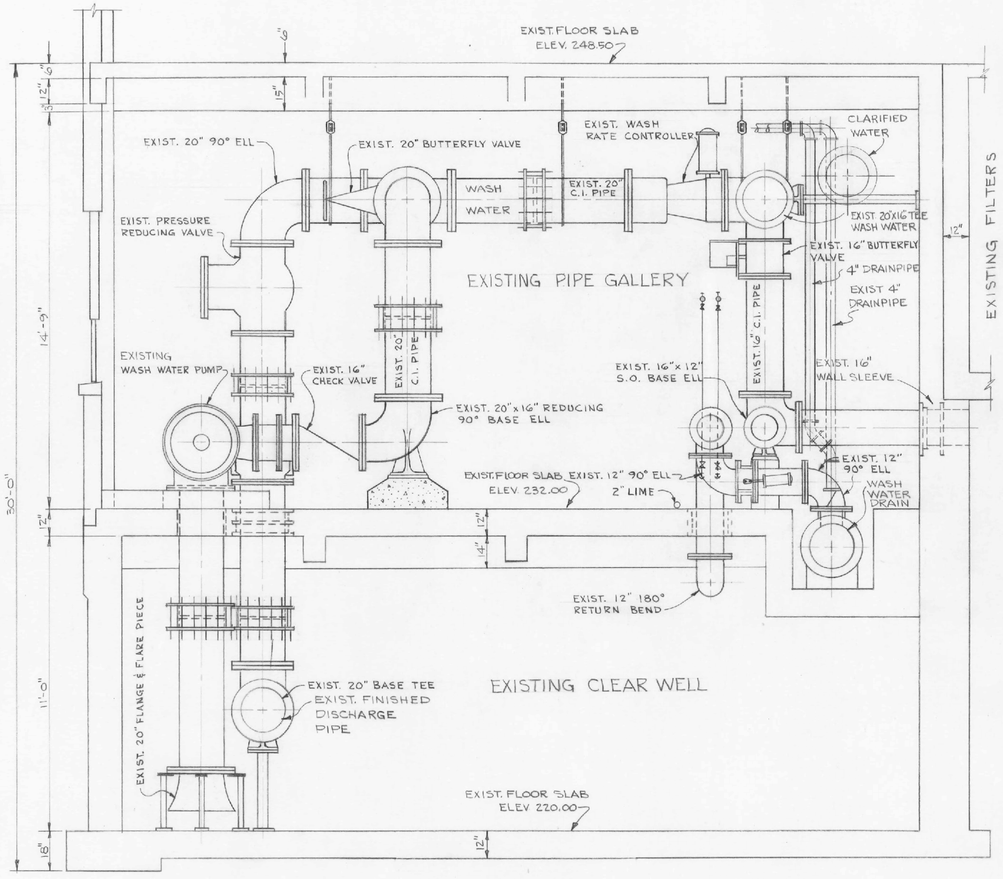
HUD PROJECT NO. WS-2-21-0001

DESIGNED	APPROVED 2/16/68 DATE	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 3/4/69 DATE	BAKER-WIBBERLEY & ASSOCIATES, INC. CONSULTING ENGINEERS HAGERSTOWN, MARYLAND	ENLARGEMENT OF WATER TREATMENT PLANT MAIN BUILDING - PIPE GALLERY SECTIONS	NO.	REVISIONS	APP'D	DATE
TRACED	DIRECTOR OF PUBLIC WORKS	PAV.		DATE PROJECT COMPLETED	William R. Moore CHIEF INSPECTOR			DATE DEC. 1965	SCALE 3/8"=1'-0"	DRAWING NO. 5 OF 36	FILE WTP-W
CHECKED		SD		DATE ACCEPTED BY CITY				JOB NO. 65-310-W			
		W		DATE TRANS. TO FINANCE DEPT., W/R 9 FORM							
		S									
		OTHER									

878 of 921



SECTION 3 - 3



SECTION 4 - 4

Edward A. Tirpak 9/1/16

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS [ ]

HUD PROJECT NO. WS - 2 - 21 - 0001

NO.	REVISIONS	APP'D	DATE
1	PLUMBING CHANGES	W.W.C.	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 9/20/16 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED 3/4/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - PIPE GALLERY
SECTIONS

DATE DEC. 1965
JOB NO. 65-310-W

SCALE 3/8"=1'-0"

DRAWING NO. 6 OF 36

FILE WTP-16

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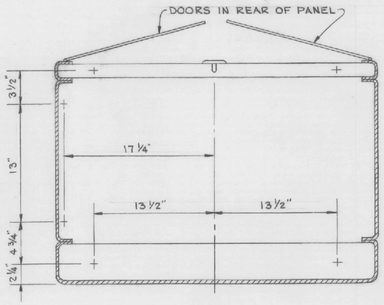
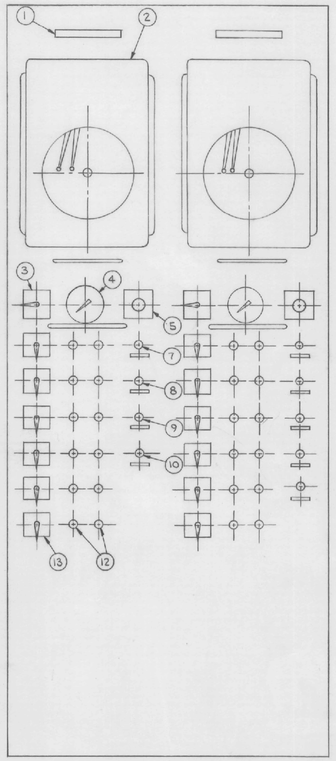
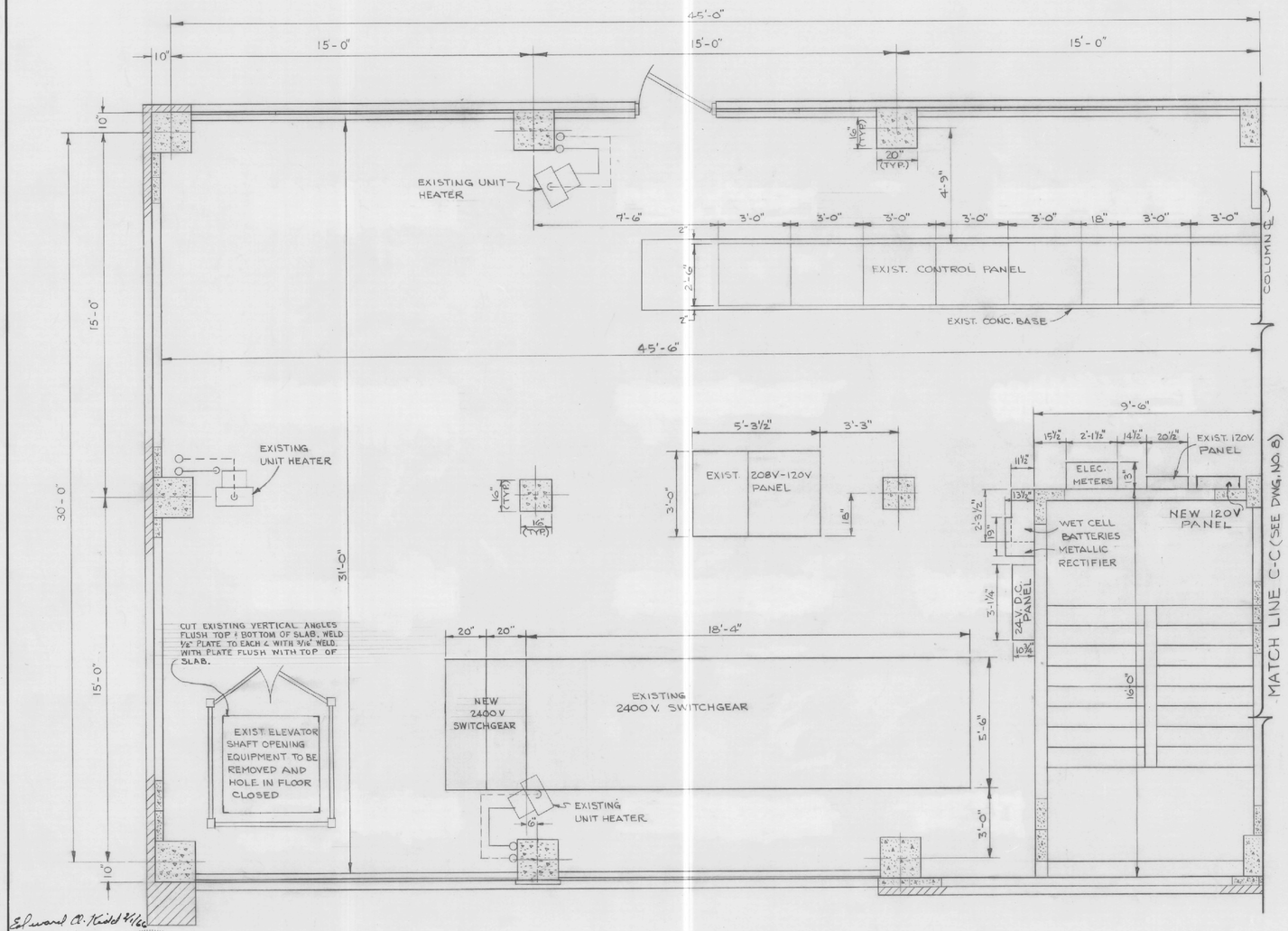
1	NAMEPLATE - FILTER NO. 2
2	MODEL ARB-2R WITH NAMEPLATE - LOSS OF HEAD & RATE OF FLOW
3	AUTO MANUAL SELECTOR } NAMEPLATE - FILTER SET RATE
4	SET RATE INDICATOR } NAMEPLATE - FILTER SET RATE
5	MANUAL RATE SETTER } NAMEPLATE - FILTER SET RATE
6	(NOT USED)
7	RED ALARM LIGHT WITH NAMEPLATE - EXCESS LOSS OF HEAD
8	PUSHBUTTON WITH NAMEPLATE - RESET WASH
9	GREEN LIGHT WITH NAMEPLATE - FILTER WASHING
10	PUSHBUTTON WITH NAMEPLATE - START WASH
11	(NOT USED)
12	VALVE POSITION LIGHTS WITH ATTACHED NAMEPLATES - OPEN (RED LIGHTS) CLOSE (GREEN LGTS)
13	VALVE POSITION SELECTORS WITH ATTACHED NAMEPLATES - INFLUENT, EFFLUENT, DRAIN & WASH



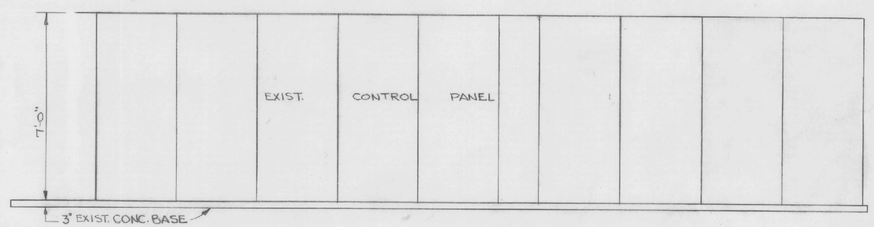


NOTE:
EQUIPMENT FOR FILTER NO. 3 IDENTICAL TO FILTER NO. 4

TYPICAL FILTER PANEL
SCALE: NO SCALE



PLAN
SCALE: 3/8"=1'-0"



CONTROL PANEL
SCALE: NO SCALE

Edward A. Kidd 3/16

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS
HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	DELETED SOME IMPROVEMENTS	Ord.	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/4/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - OPERATING FLOOR
PLAN AND DETAILS

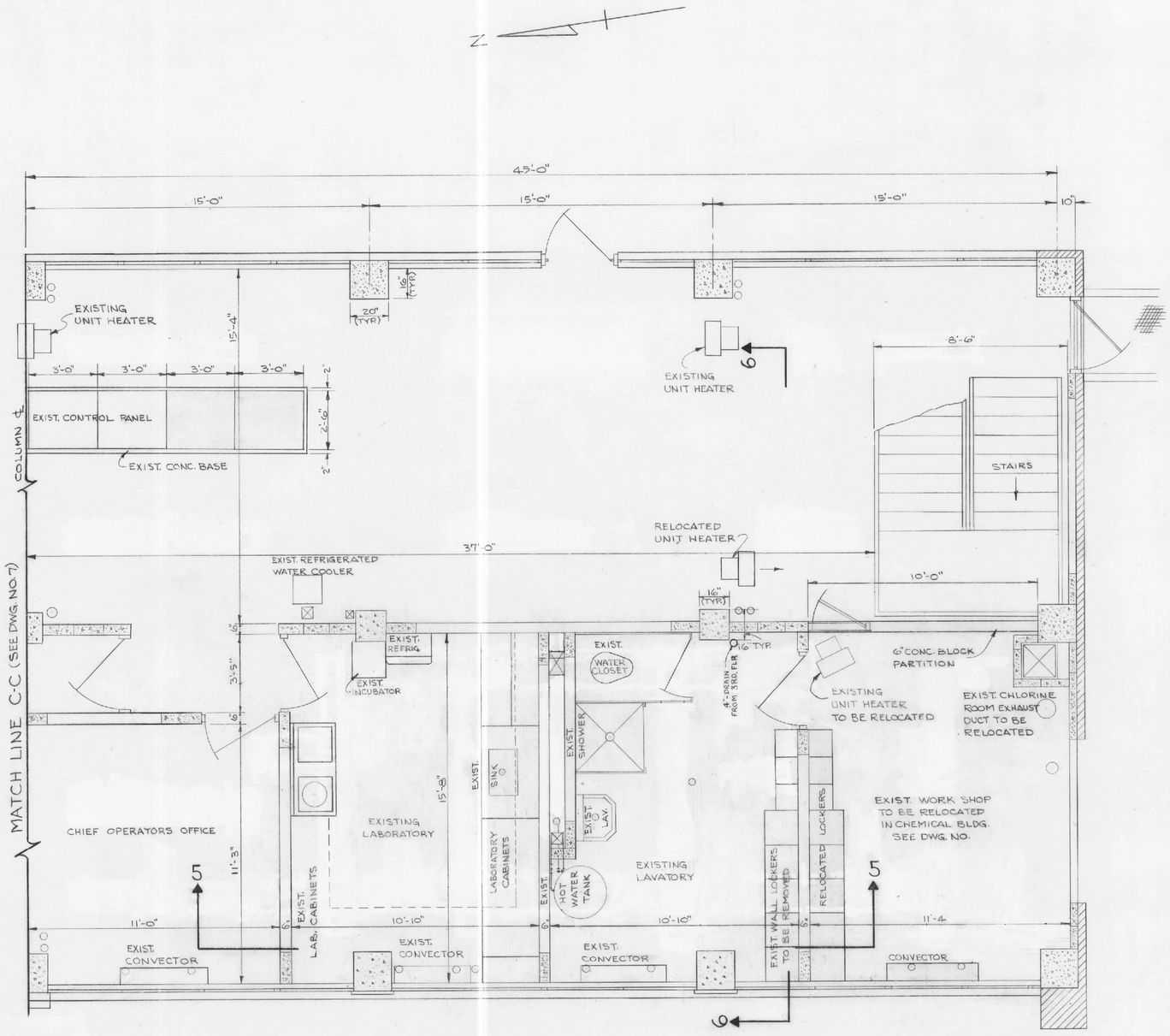
DATE DEC. 1965
JOB NO. 65-310-W

SCALE AS SHOWN

DRAWING NO. 7 OF 36

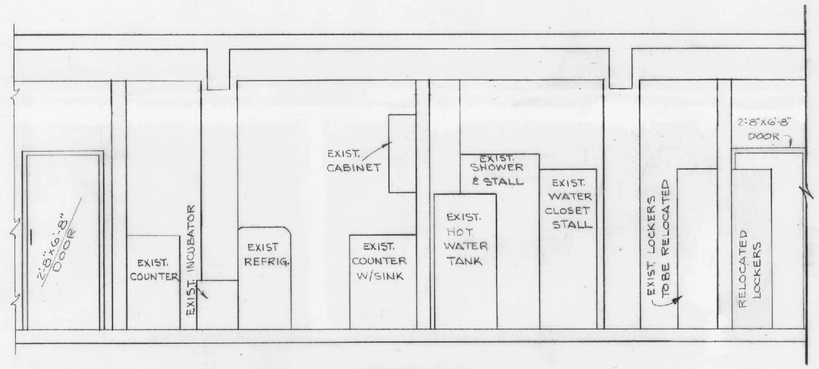
FILE WTP-1

880 of 921



PLAN

SCALE: 3/8"=1'-0"



SECTION 5-5

SCALE: 3/8"=1'-0"

SECTION 6-6

SCALE: 3/8"=1'-0"

Edmund A. Kidd 2/1/66

MAJOR WORK UNDER THIS CONTRACT SHOWN THUS [ ]

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	DELETED SOME IMPROVEMENTS		JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

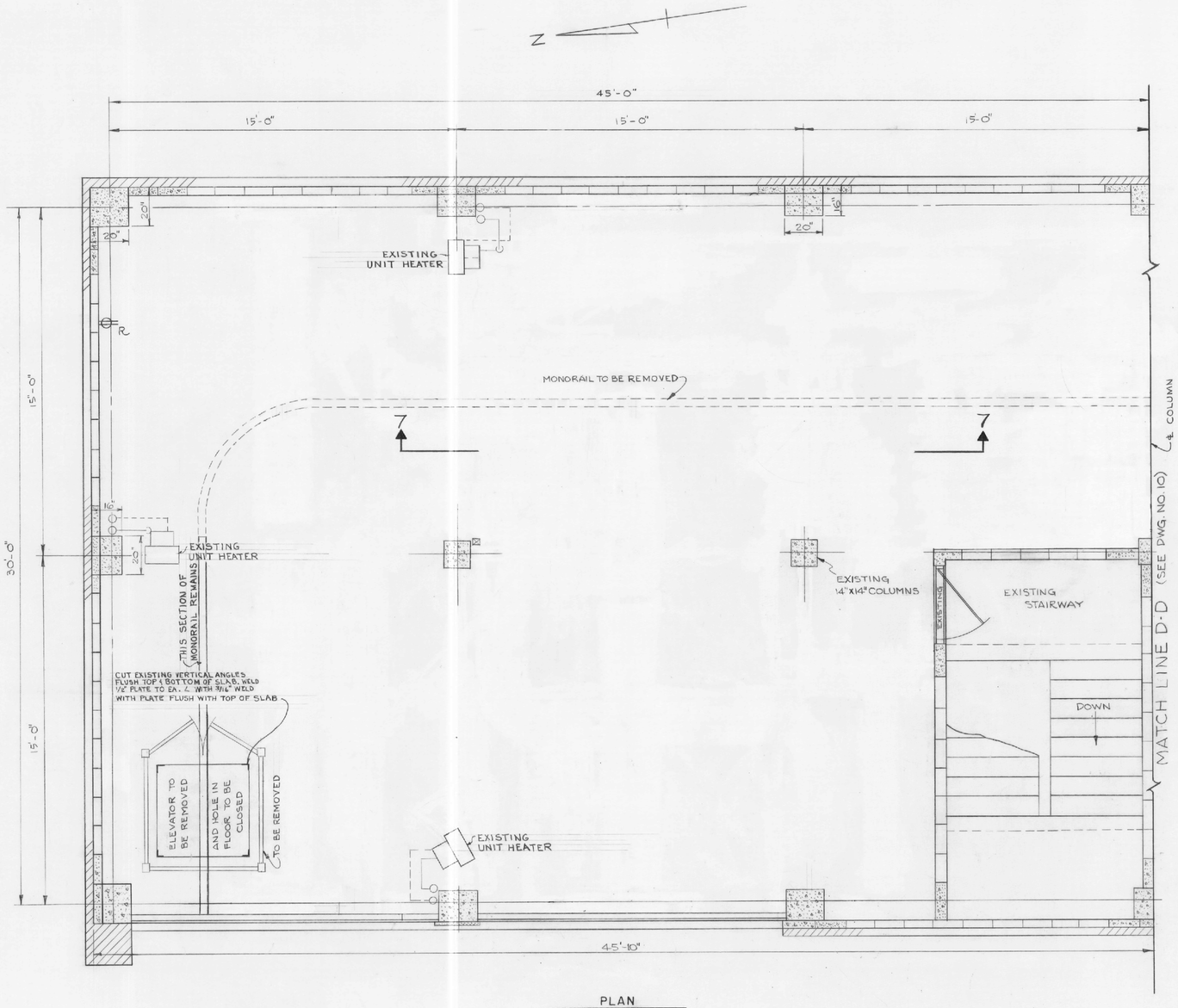
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/4/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - OPERATING FLOOR
PLAN AND SECTIONS

DATE DEC. 1965
JOB NO. 65-310-W
SCALE AS SHOWN
DRAWING NO. 8 OF 36
FILE WTP-10



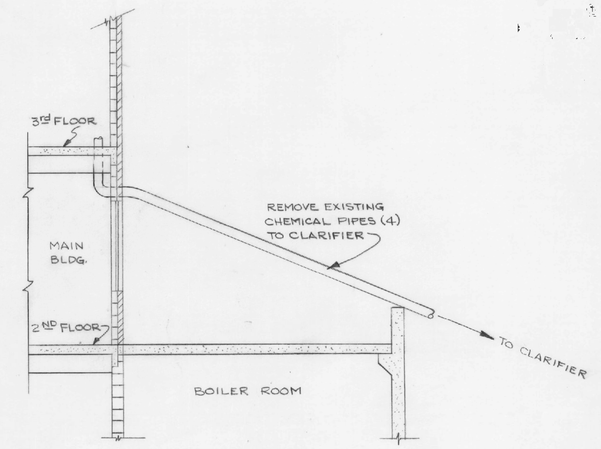
PLAN

SCALE: 3/8" = 1'-0"

THIS SECTION DELETED DUE TO REVISIONS.

SECTION 7-7

SCALE: 3/8" = 1'-0"



DETAIL OF EXISTING CHEMICAL PIPING TO CLARIFIER

SCALE: 1/4" = 1'-0"

Edward A. Kriebel 8/1/66

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	DELETED SOME IMPROVEMENTS	[illegible]	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 7/11/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/4/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - THIRD FLOOR
PLAN, SECTION AND DETAILS

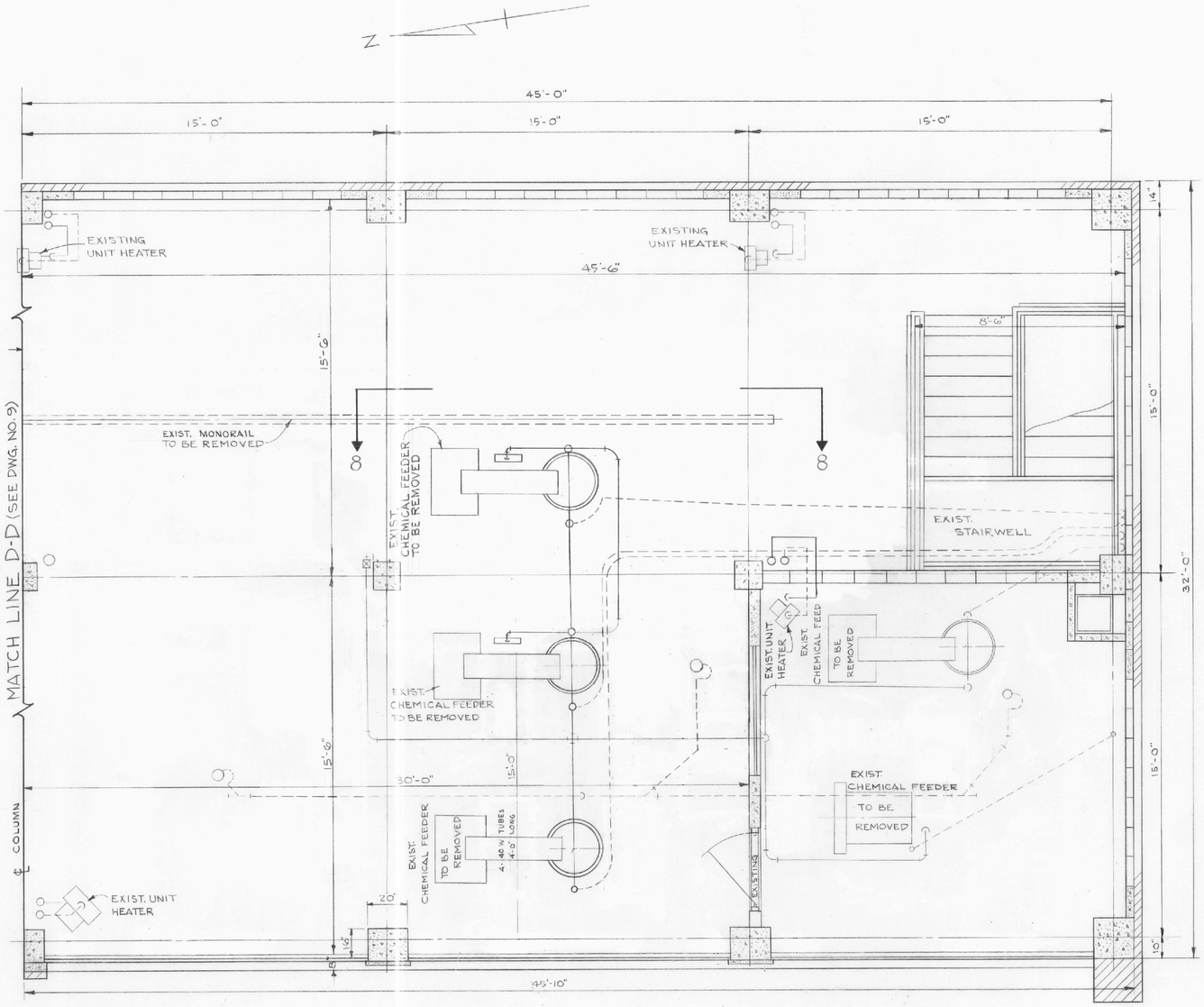
DATE: DEC. 1965
JOB NO. 65-310-W

SCALE: AS SHOWN

DRAWING NO. 9 OF 36

FILE WTP-16

002 of 321



PLAN

SCALE : 3/8"=1'-0"

THIS SECTION DELETED DUE TO REVISIONS.

SECTION 8-8

SCALE: 3/8"=1'-0"

Edward C. Kidd 3/1/66

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	DELETED SOME IMPROVEMENTS	WLR	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 3/1/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/4/68 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

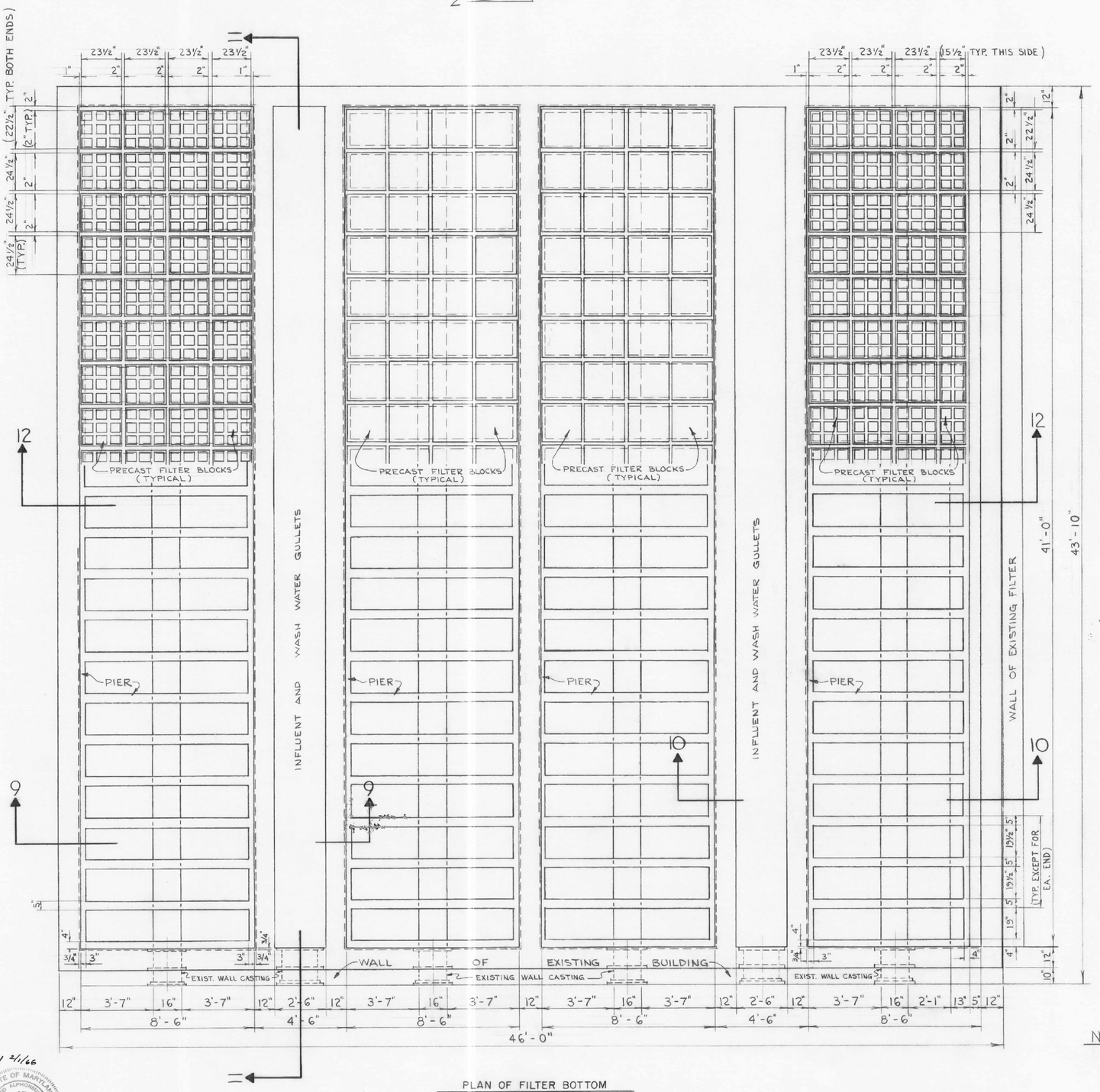
ENLARGEMENT OF WATER TREATMENT PLANT
MAIN BUILDING - THIRD FLOOR
PLAN AND SECTIONS

DATE: DEC. 1965
JOB NO. 65-310-W

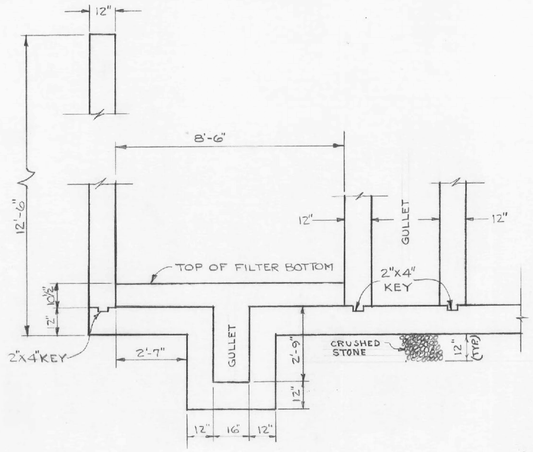
SCALE: AS SHOWN

DRAWING NO. 10 OF 36

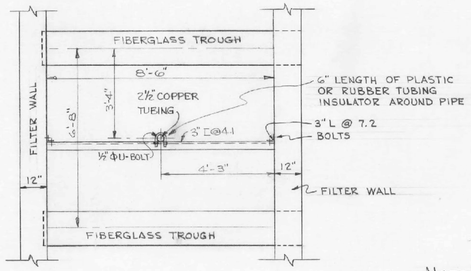
FILE WTP-10



PLAN OF FILTER BOTTOM

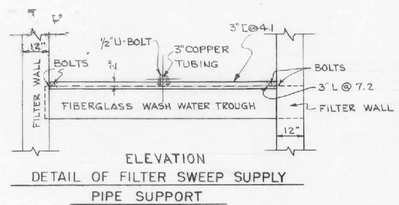


SECTION 9-9

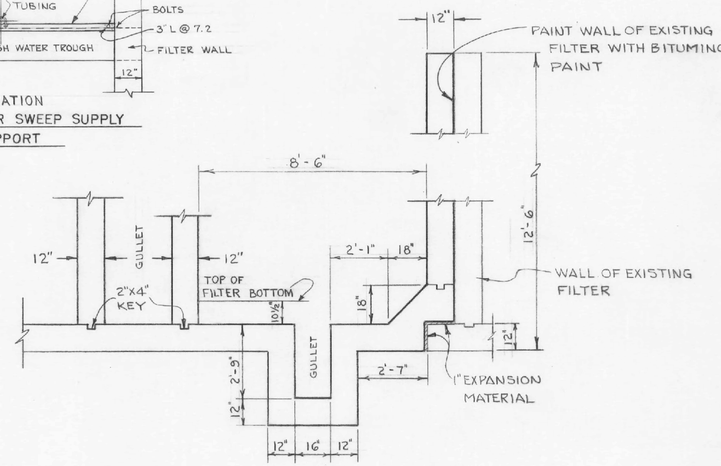


PLAN
DETAIL OF FILTER SWEEP CENTER PIPE SUPPORT

NOTE:
FILTER SWEEP PIPE SUPPORTS IN EXISTING FILTERS TO BE AS SHOWN ON DETAILS, ALSO



ELEVATION
DETAIL OF FILTER SWEEP SUPPLY PIPE SUPPORT



SECTION 10-10

NOTE:
ONE FOOT OF CRUSHED STONE UNDER ENTIRE FILTER

Edward A. Kidd 3/1/66

STATE OF MARYLAND EDWARD ALPHONSUS KIDD No. 3941 REGISTERED PROFESSIONAL ENGINEER

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

DESIGNED
TRACED
CHECKED

APPROVED 3/14/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

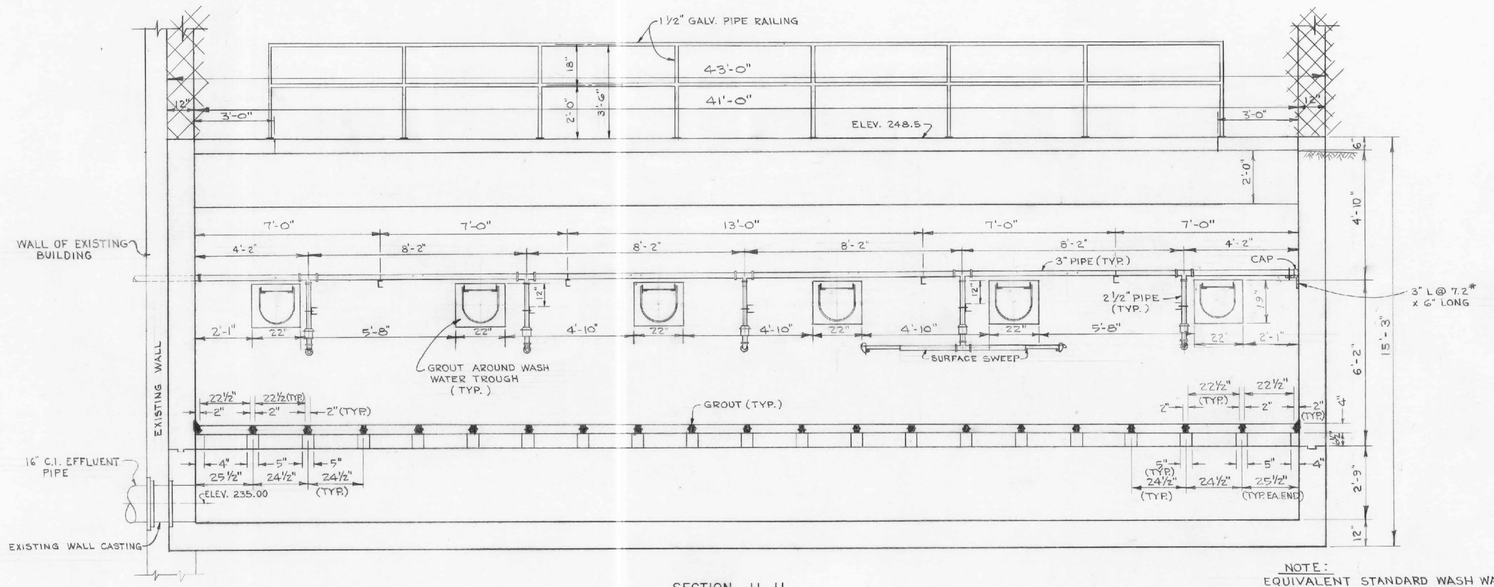
AS BUILT COMPLETED 5/4/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
ADDITIONAL FILTERS
PLAN, SECTIONS AND DETAILS

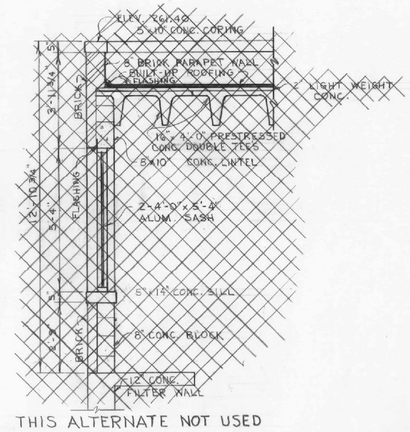
DATE DEC. 1965
JOB NO. 65-310-W
SCALE 3/8"=1'-0"
DRAWING NO. 11 OF 36
FILE WTP-1

884 of 921



SECTION 11-11

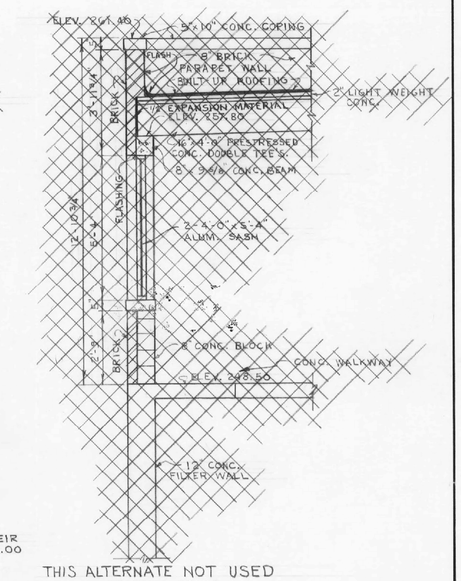
SCALE: 3/8"=1'-0"



THIS ALTERNATE NOT USED

SECTION 13-13

SCALE: 3/8"=1'-0"

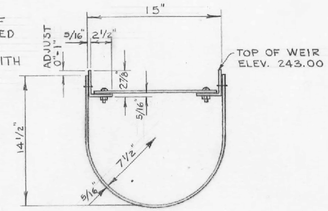


THIS ALTERNATE NOT USED

SECTION 14-14

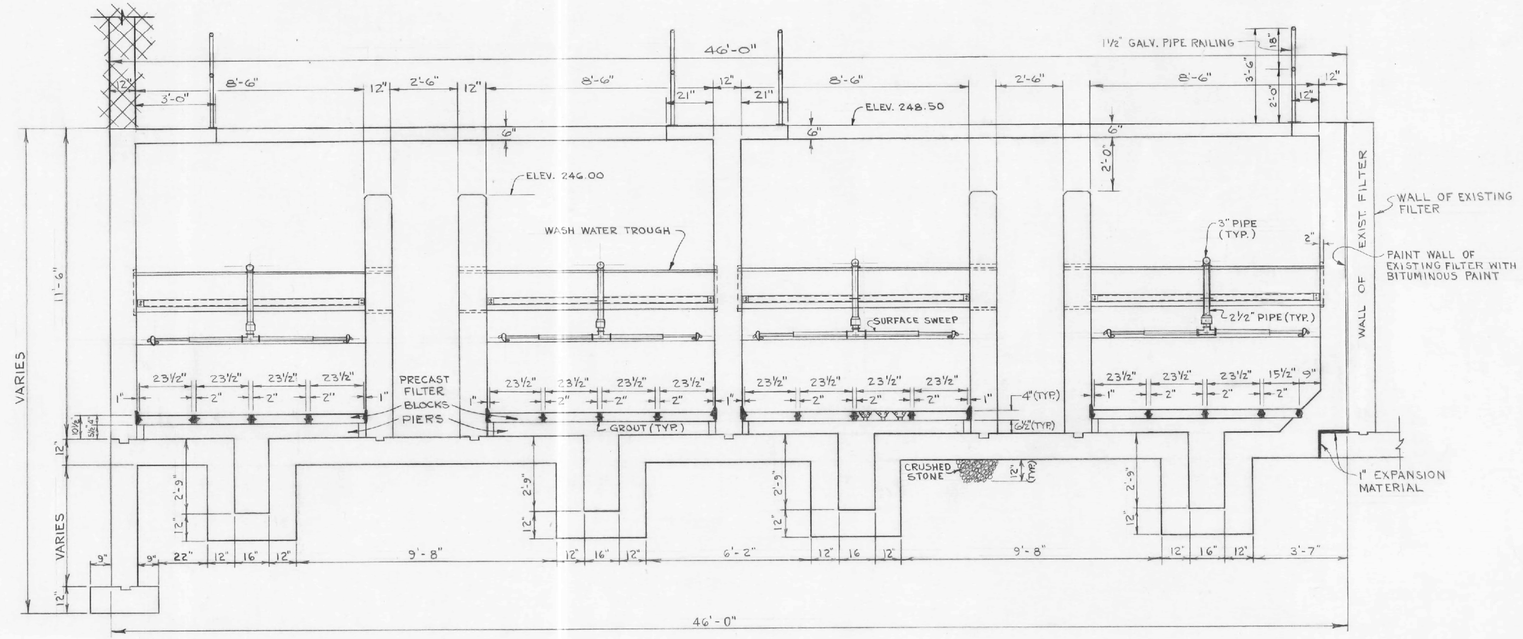
SCALE: 3/8"=1'-0"

NOTE:
EQUIVALENT STANDARD WASH WATER TROUGHS OF B.I.F., LEOPOLD, WARMINSTER, REINHOLD OR APPROVED EQUAL HAVING THE SAME OR GREATER CAPACITY AS THAT SHOWN AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS WILL BE ACCEPTABLE.



DETAIL OF WASH WATER TROUGH

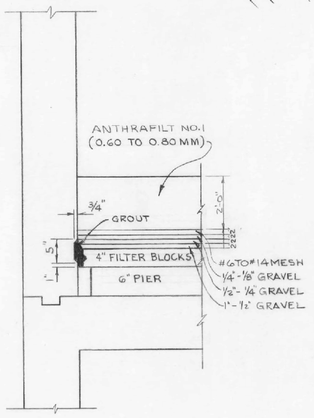
SCALE: 1 1/2"=1'-0"



SECTION 12-12

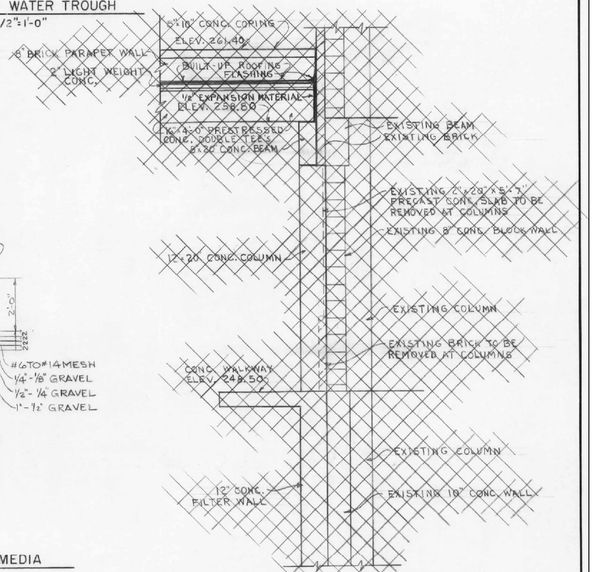
SCALE: 3/8"=1'-0"

NOTE:
ONE FOOT OF CRUSHED STONE UNDER ENTIRE FILTER



DETAIL OF FILTER BOTTOM AND MEDIA

SCALE: 3/4"=1'-0"



THIS ALTERNATE NOT USED

SECTION 15-15

SCALE: 3/8"=1'-0"

Edward C. Kidd 3/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	WASH WATER TROUGH DETAIL	EJK	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 3/1/66
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

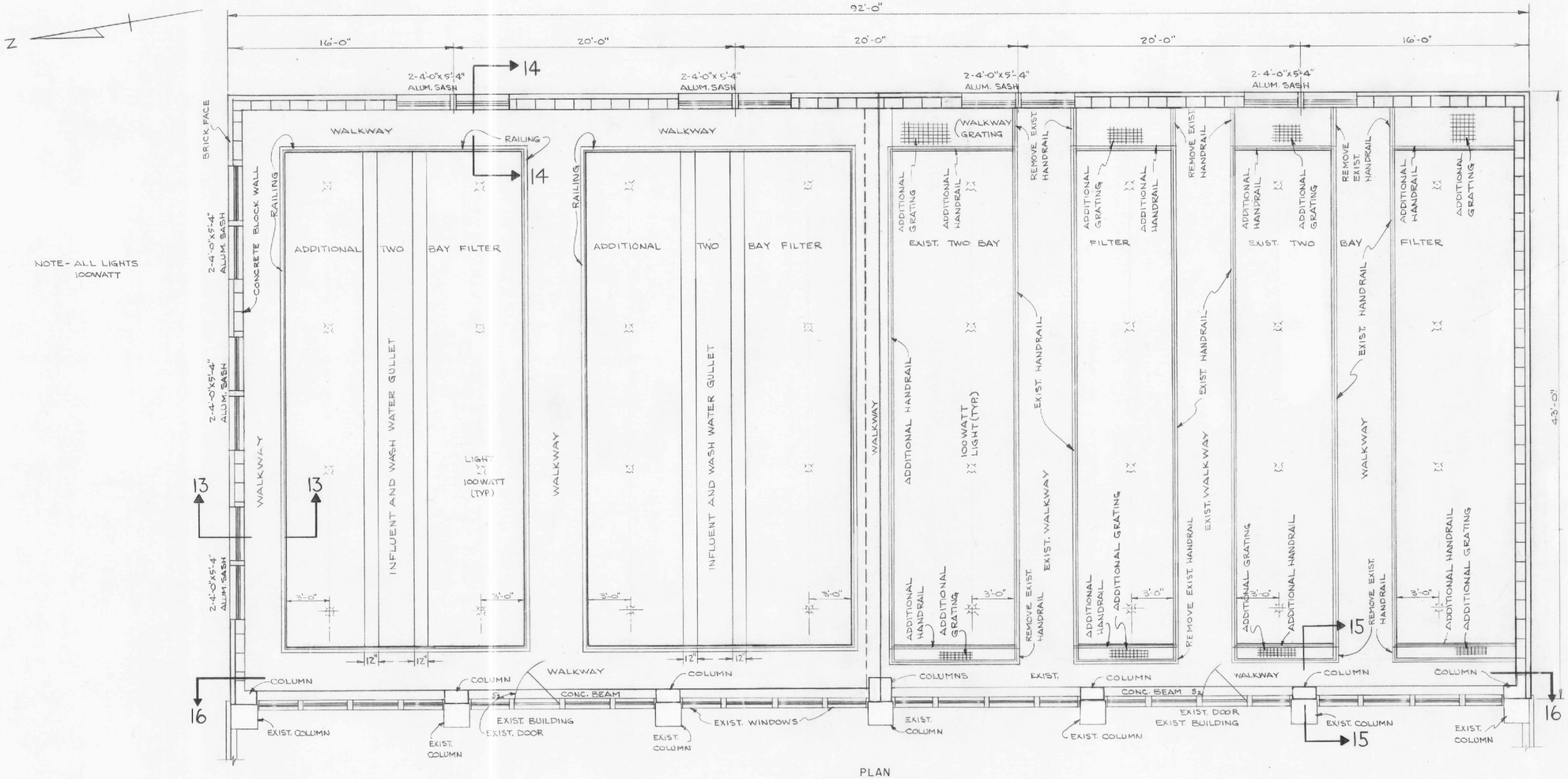
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED 9/4/69
DATE
CHIEF INSPECTOR

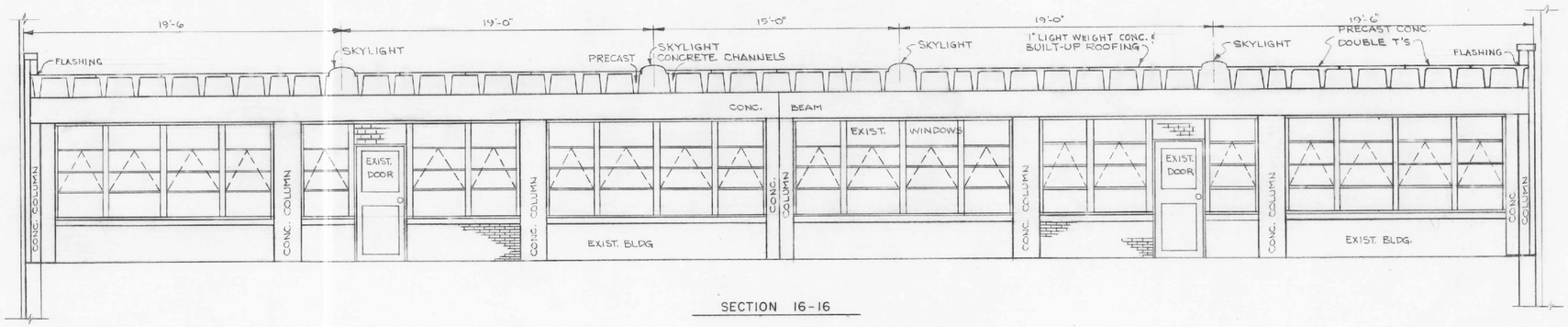
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
ADDITIONAL FILTERS
SECTIONS AND DETAILS

DATE DEC. 1965
JOB NO. 65-310-W
SCALE AS SHOWN
DRAWING NO. 12 OF 36
FILE WTP-12

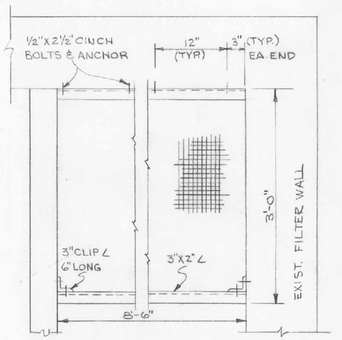


PLAN

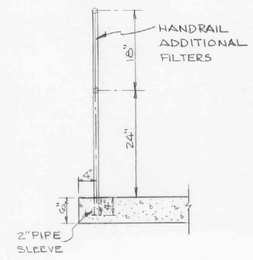


SECTION 16-16

THIS ALTERNATE NOT USED



DETAILS
WALKWAY GRATING
SCALE: 1"=1'-0"



DETAIL
HANDRAIL
SCALE: 3/4"=1'-0"

Edward A. Riddel 9/1/66

STATE OF MARYLAND EDWARD ALPHONSUS RIDDEL No. 3618 REGISTERED PROFESSIONAL ENGINEER

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

DESIGNED
TRACED
CHECKED

APPROVED _____ DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED
DATE
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

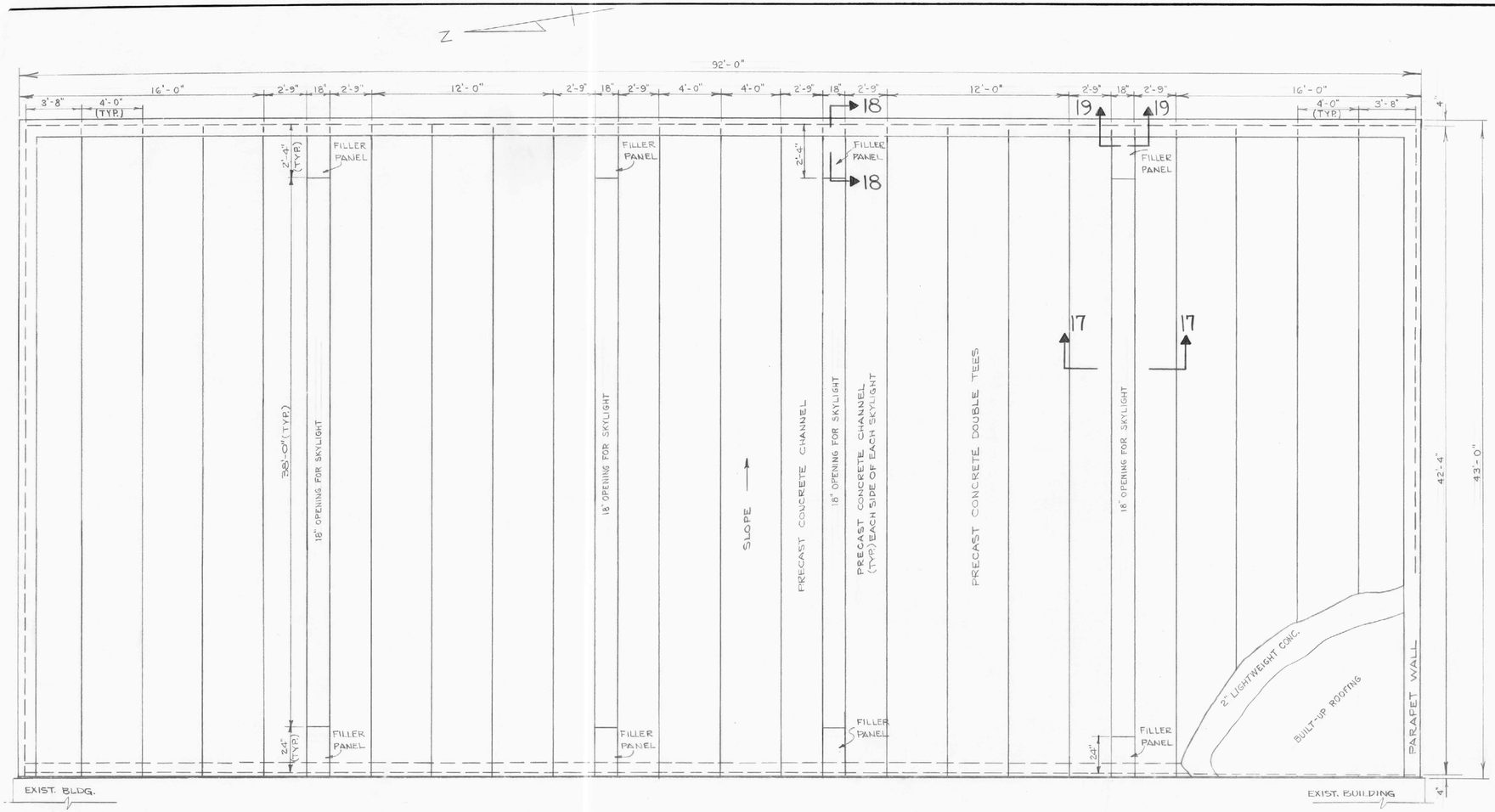
ENLARGEMENT OF WATER TREATMENT PLANT
FILTER SUPERSTRUCTURE
PLAN AND SECTION

DATE DEC. 1965
JOB NO. 65-310-W

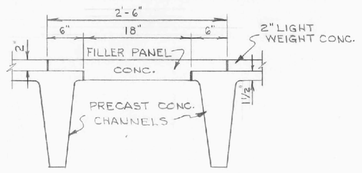
SCALE 1/4"=1'-0"

DRAWING NO. 13 OF 36

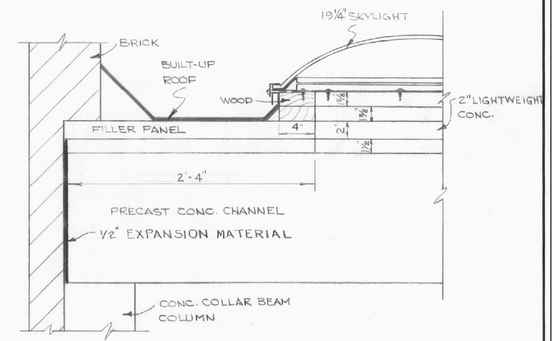
FILE WTP-16



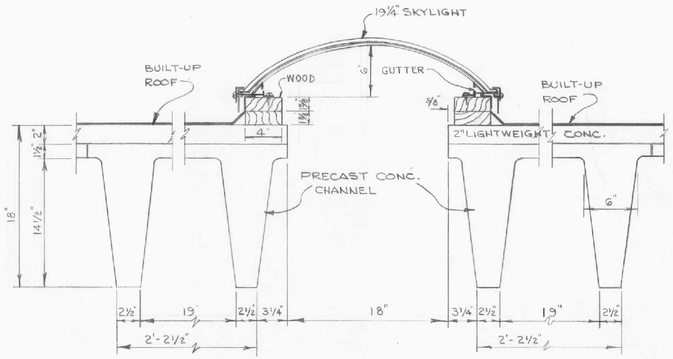
ROOF PLAN
SCALE: 1/4"= 1'-0"



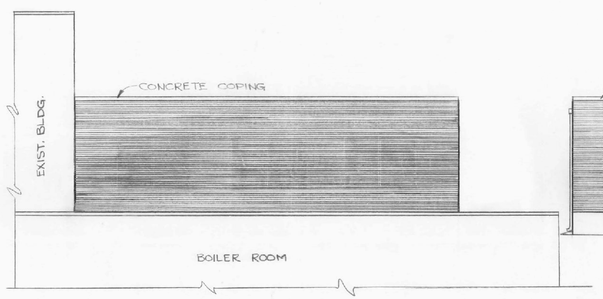
SECTION 19-19
SCALE: 1 1/2"=1'-0"



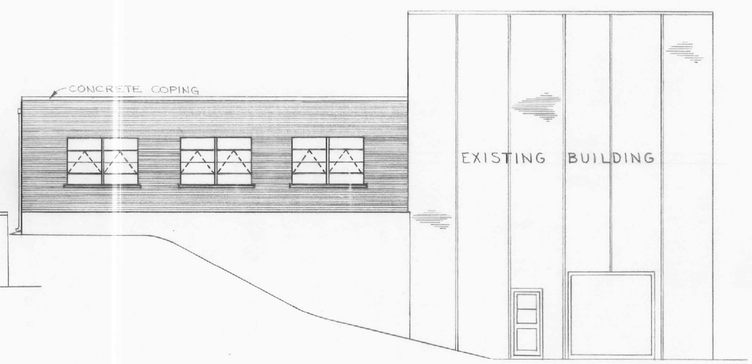
SECTION 18-18
SCALE: 1 1/2"= 1'-0"



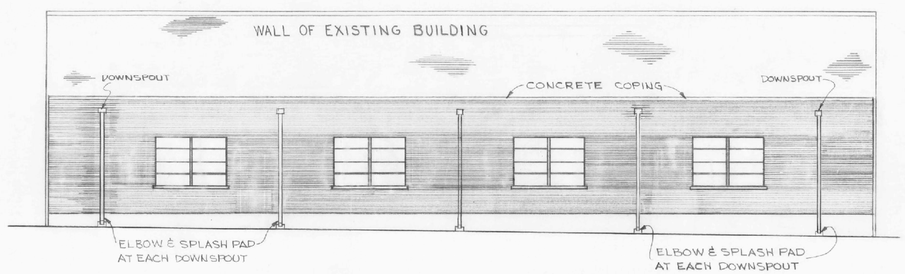
SECTION 17-17
SCALE: 1 1/2"= 1'-0"



SOUTH ELEVATION
SCALE: 1/8"= 1'-0"



NORTH ELEVATION
SCALE: 1/8"= 1'-0"



EAST ELEVATION
SCALE: 1/8"= 1'-0"

Edward A. Waidel 4/1/66

STATE OF MARYLAND — EDWARD ALPHONSUS WAIDEL — No. 3641 — REGISTERED PROFESSIONAL ENGINEER

THIS ALTERNATE NOT USED

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

CITY OF ROCKVILLE MARYLAND

DESIGNED
TRACED
CHECKED

APPROVED 2/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED
DATE
CHIEF INSPECTOR

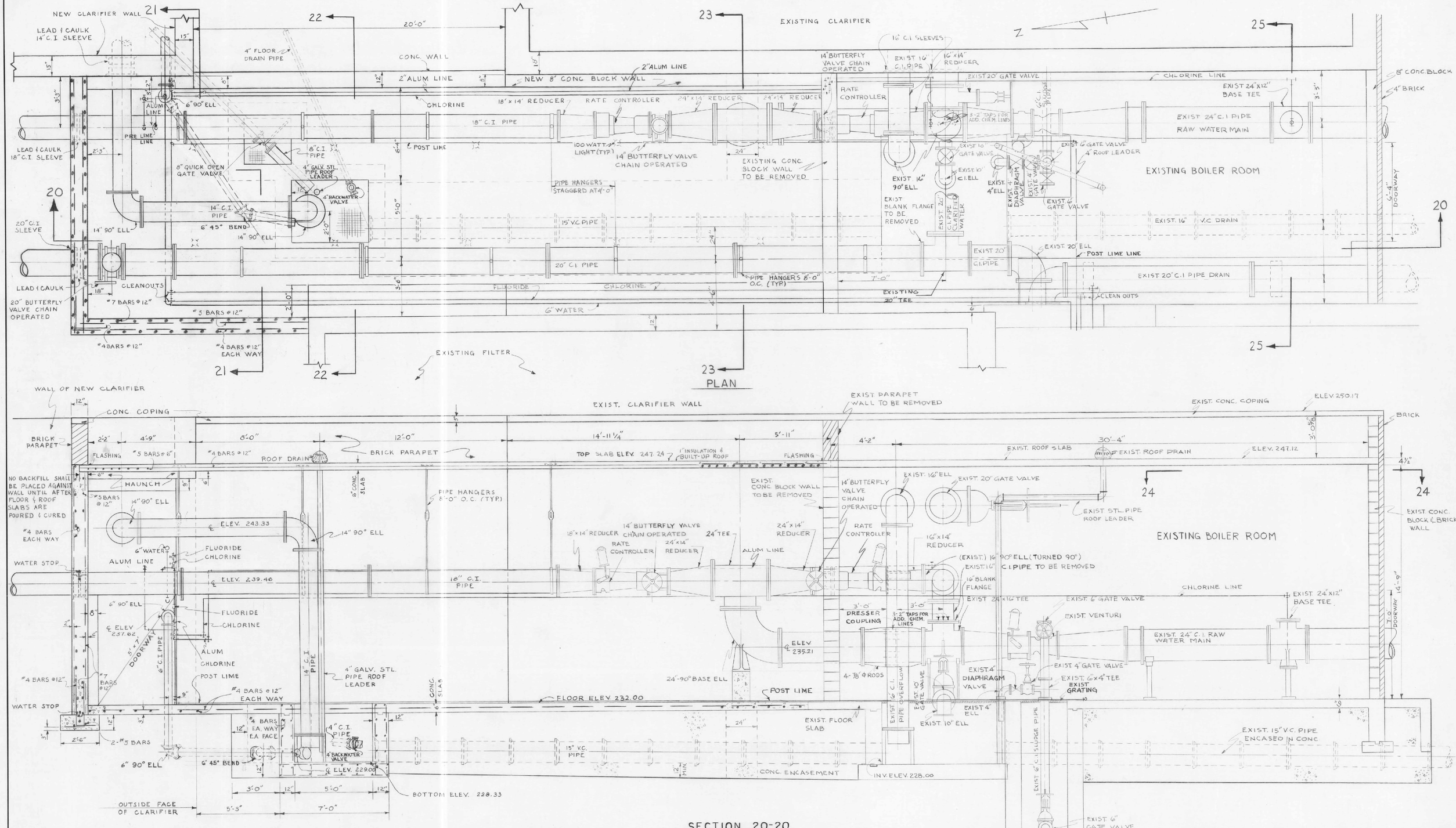
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
FILTER SUPERSTRUCTURE
PLAN, SECTIONS AND ELEVATIONS

NO.	REVISIONS	APP'D	DATE

DATE: DEC. 1965
JOB NO.: 65-310-W
SCALE: AS SHOWN
DRAWING NO. 14 OF 36
FILE: WTP-14

307 of 321



NOTE: ALL LIGHTS IN BOILER ROOM EXTENSION TO BE 100 WATT

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

THIS SHEET REPLACES SHEET NUMBER 15			
NO.	REVISIONS	APP'D	DATE

Examined & Passed 9/7/67

DESIGNED
TRACED
CHECKED

APPROVED Sept. 14, 1967 (DATE)
Fred L. Rothgeb
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

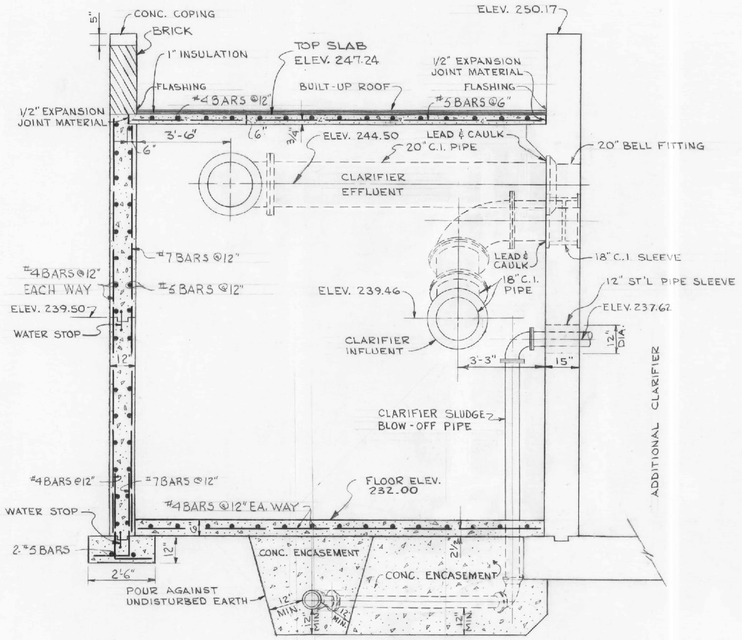
AS BUILT COMPLETED 9/8/69 (DATE)
William R. Moore
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
BOILER ROOM
PLAN AND SECTION

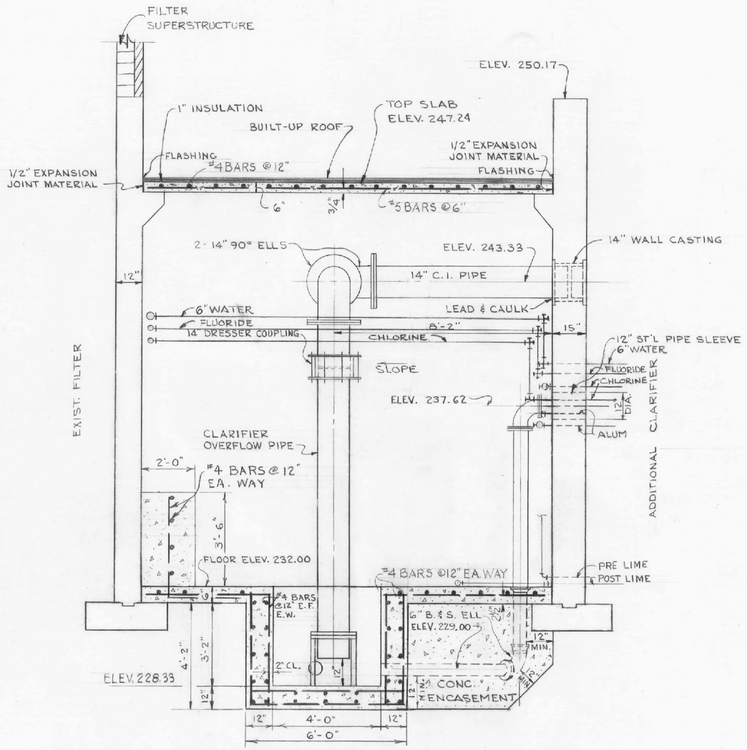
DATE	SCALE	DRAWING	FILE
AUG. 1967	3/8"=1'-0"	NO. 15-R	WTP-1
JOB NO. 65-310-W		OF 36	

885 of 921



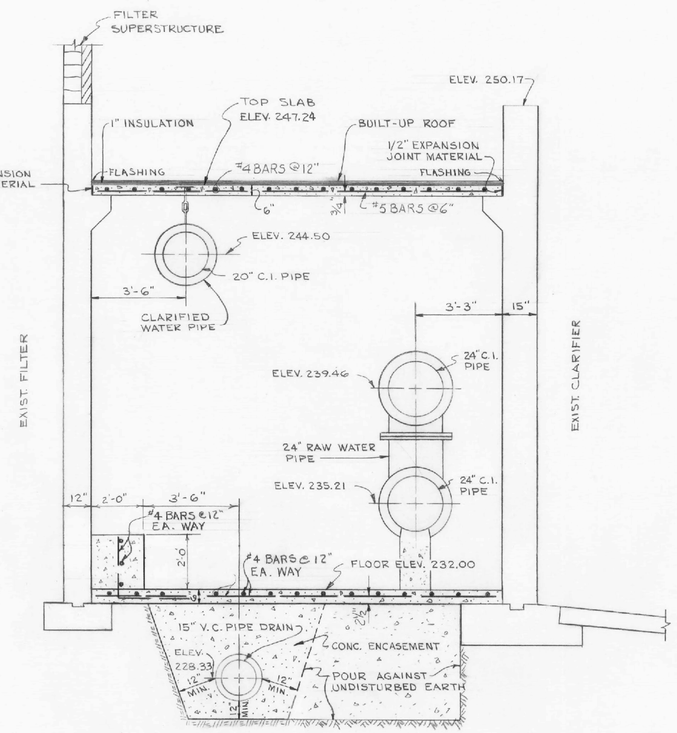
SECTION 21-21

SCALE: 3/8"= 1'-0"



SECTION 22-22

SCALE: 3/8"= 1'-0"



SECTION 23-23

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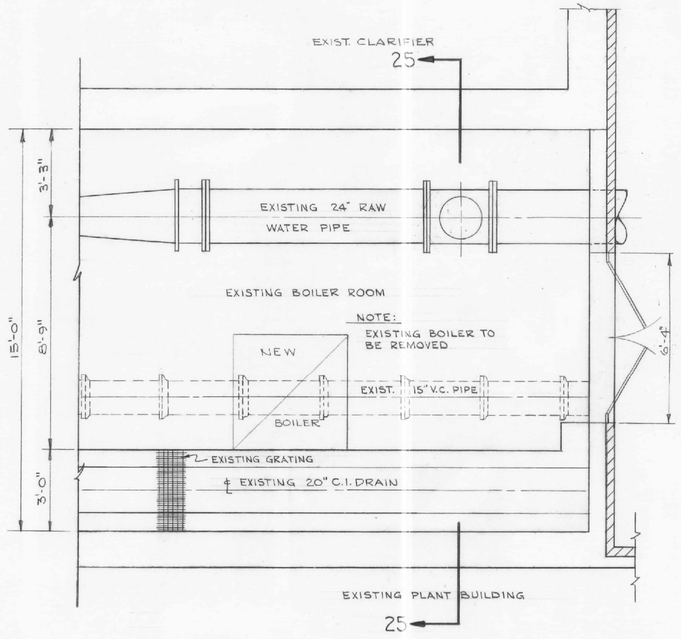
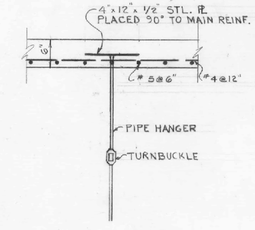


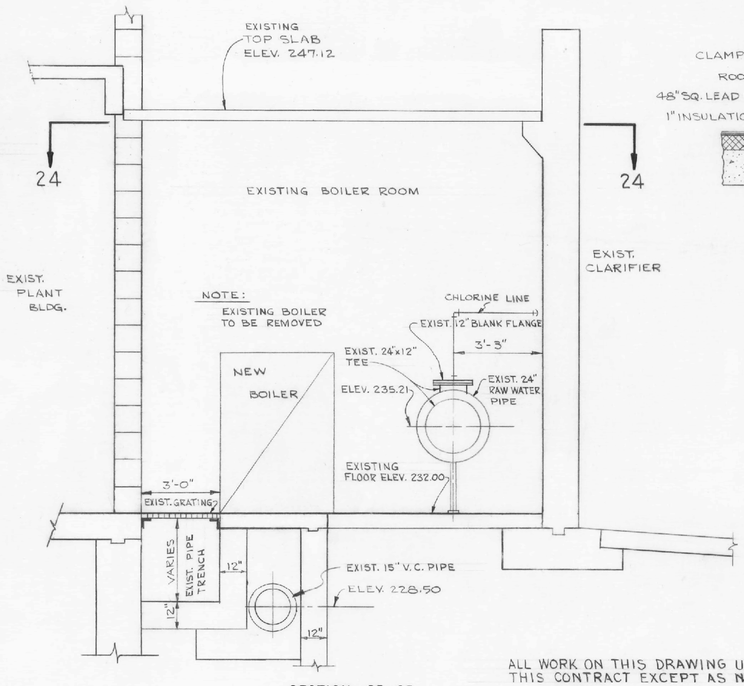
SECTION 24-24

SCALE: 3/8"= 1'-0"



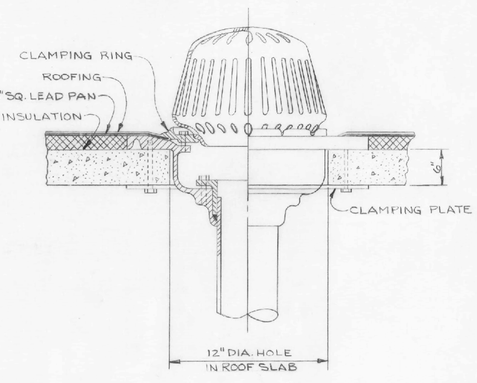
DETAIL OF PIPE HANGERS

SCALE: 3/4"= 1'-0"



SECTION 25-25

SCALE: 3/8"= 1'-0"



DETAIL OF ROOF DRAIN

NO SCALE

Edward A. Kidd 8/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED CHEM. PIPING	[illegible]	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 8/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

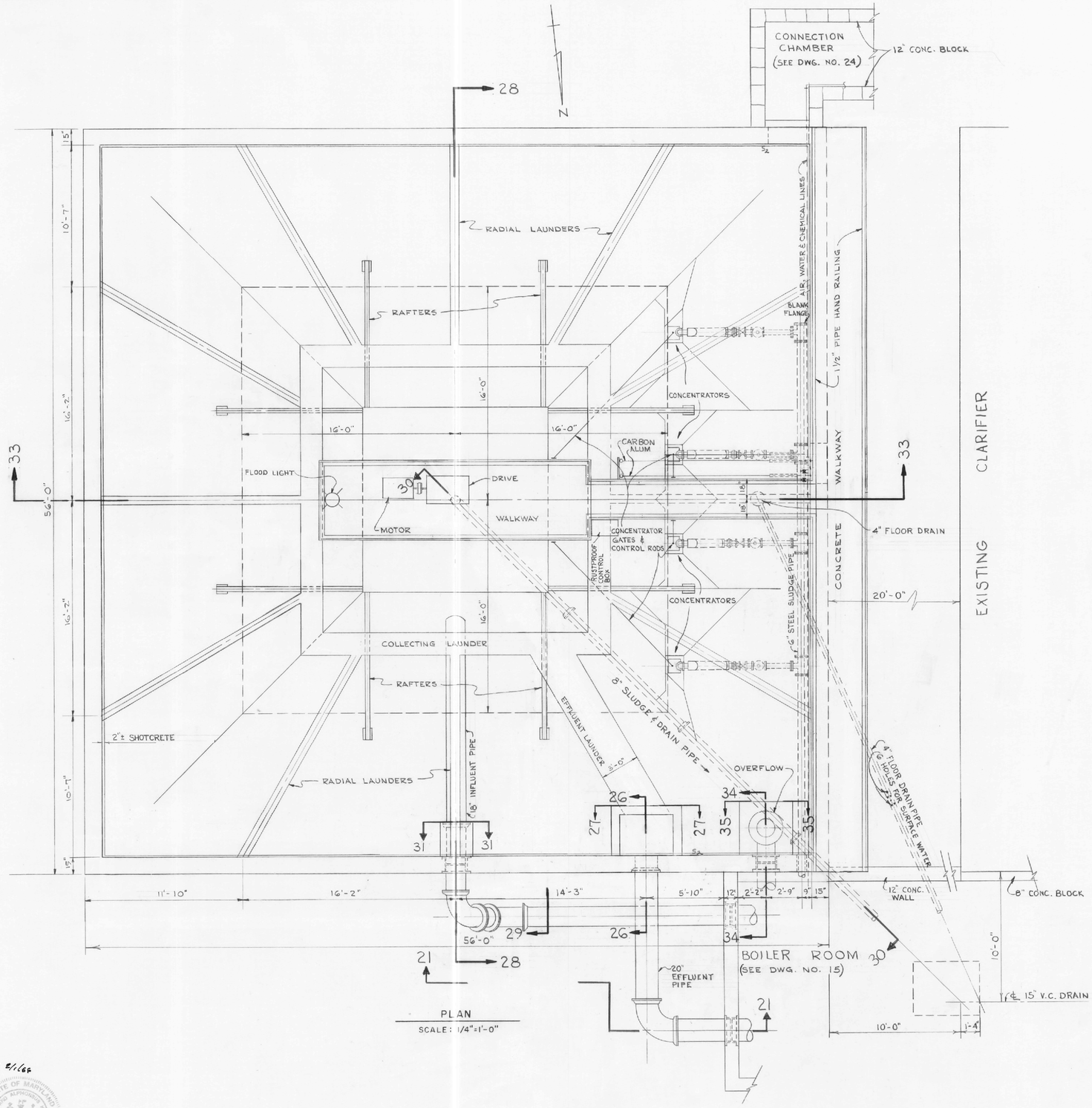
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

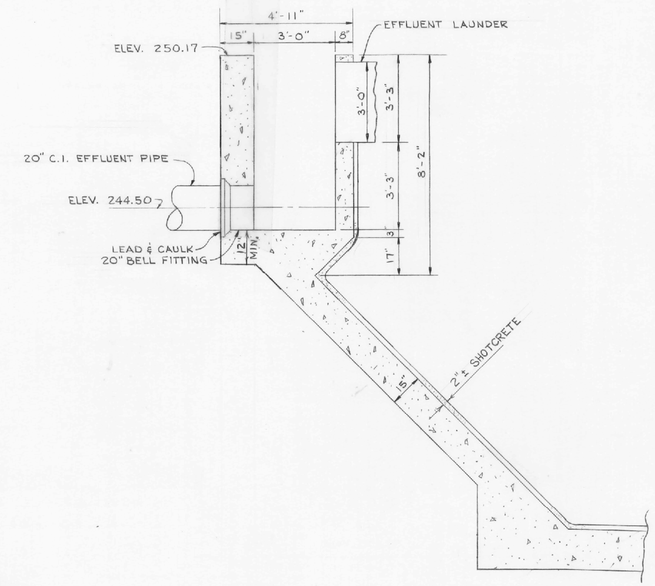
AS BUILT COMPLETED 9/8/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
BOILER ROOM
SECTIONS AND DETAIL

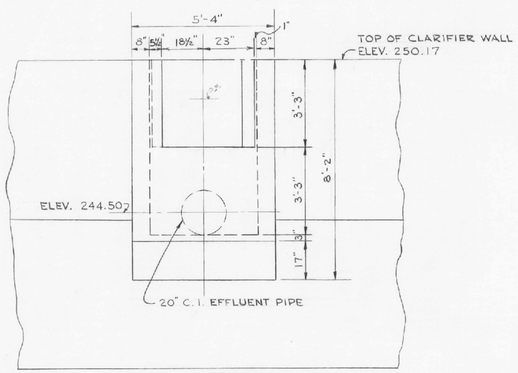
DATE: DEC. 1965
JOB NO. 65-310-W
SCALE: AS SHOWN
DRAWING NO. 16 OF 36
FILE WTP-16





SECTION 26 - 26

SCALE: 3/8"=1'-0"



SECTION 27 - 27

SCALE: 3/8"=1'-0"

Edward A. Kidd 2/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS - 2 - 21 - 0001

NO.	REVISIONS	APP'D	DATE
1	REVISED CHEM. & SLUDGE PIPING		JAN., 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/4/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/3/68 DATE
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

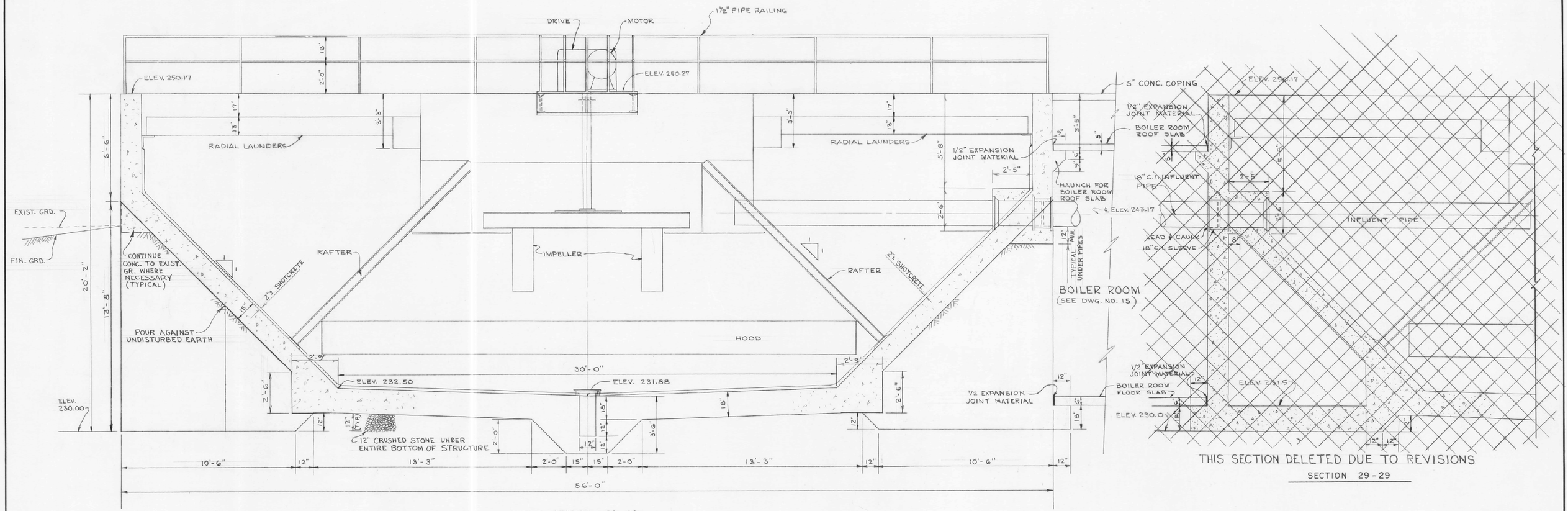
ENLARGEMENT OF WATER TREATMENT PLANT
CLARIFIER
PLAN AND SECTIONS

DATE DEC. 1965
JOB NO. 65-310-W

SCALE AS SHOWN

DRAWING NO. 17 OF 36

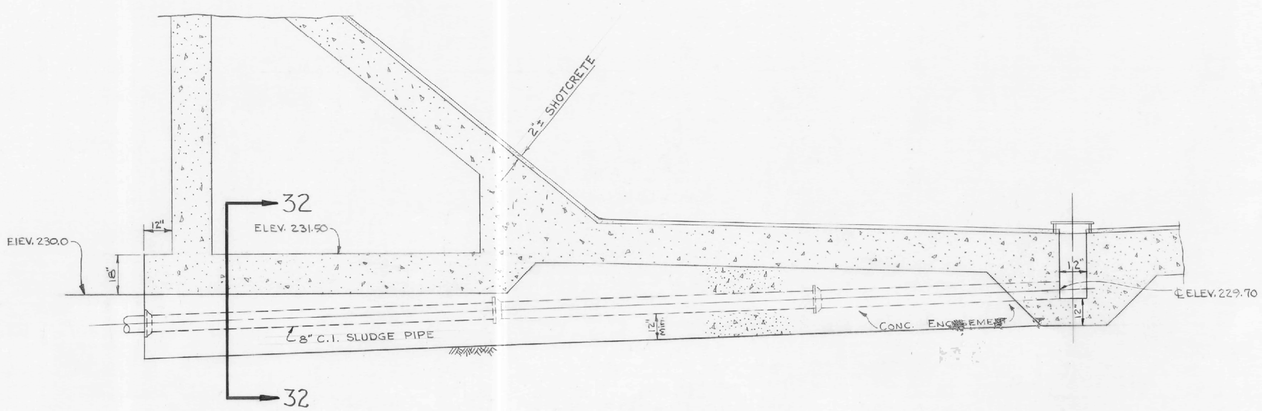
FILE WTP-10



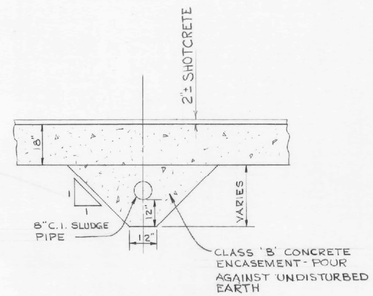
SECTION 28 - 28

THIS SECTION DELETED DUE TO REVISIONS

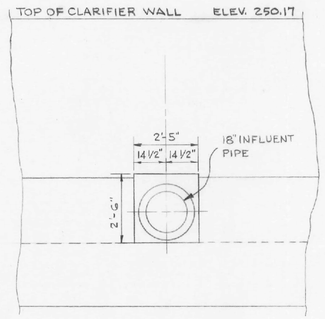
SECTION 29-29



SECTION 30 - 30



SECTION 32-32



SECTION 31 - 31

Edward A. Kidd 2/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT

HUD PROJECT NO. WS - 2 - 21 - 000!

NO.	REVISIONS	APP'D	DATE
1	REVISED CONC. IN STRUCTURE		JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/1/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

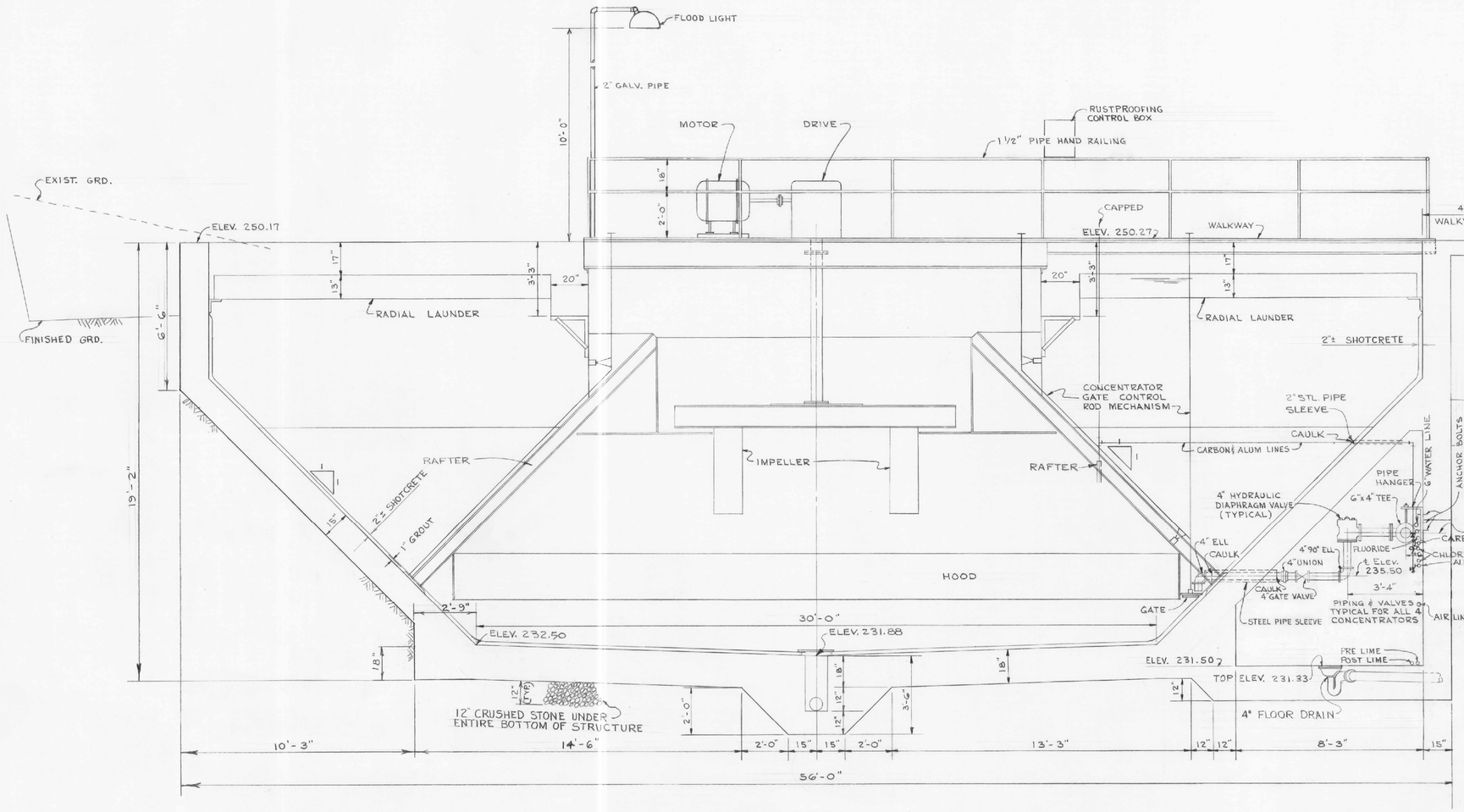
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 2/10/69 DATE
William R. Moore CHIEF INSPECTOR

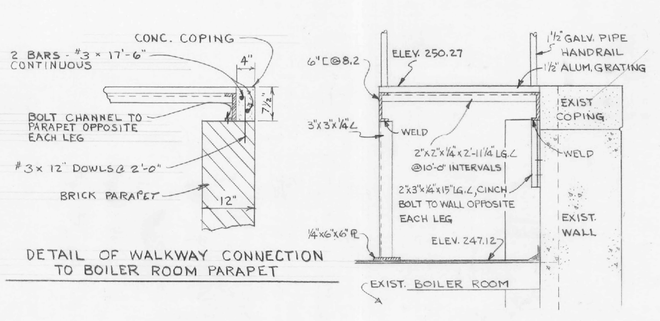
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CLARIFIER
SECTIONS

DATE DEC. 1965
JOB NO. 65-310-W
SCALE 3/8"= 1'-0"
DRAWING NO. 18 OF 36
FILE WTP-18



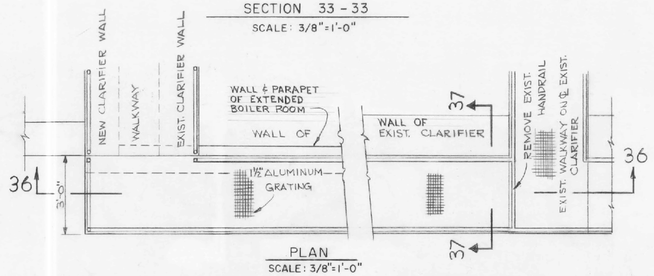
SECTION 34-34
SCALE: 3/8"=1'-0"



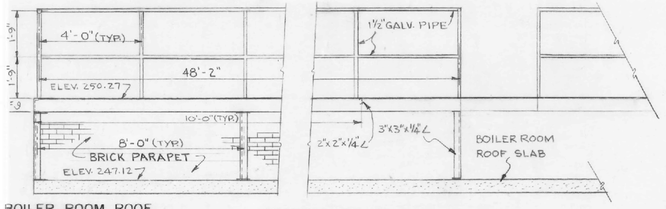
DETAIL OF WALKWAY CONNECTION TO BOILER ROOM PARAPET

SECTION 37-37
SCALE: 3/4"=1'-0"

SECTION 33-33
SCALE: 3/8"=1'-0"

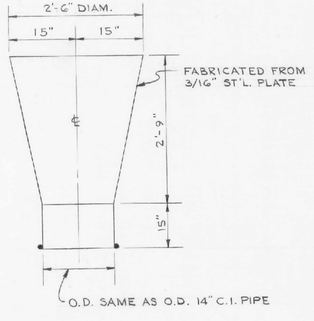


PLAN
SCALE: 3/8"=1'-0"

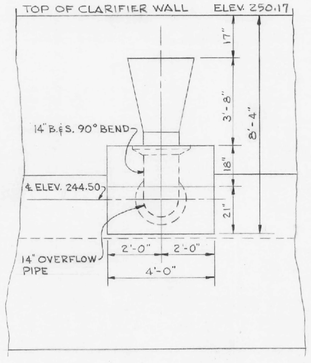


DETAIL OF PLATFORM ON BOILER ROOM ROOF

SECTION 36-36
SCALE: 3/8"=1'-0"



DETAIL OF OVERFLOW
SCALE: 3/4"=1'-0"



SECTION 35-35
SCALE: 3/8"=1'-0"

Edward A. Kidd 3/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED PIPING & CONC.	[illegible]	JAN. 1967

DESIGNED
TRACED
CHECKED
APPROVED 2/16/66 DATE
DIRECTOR OF PUBLIC WORKS
GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

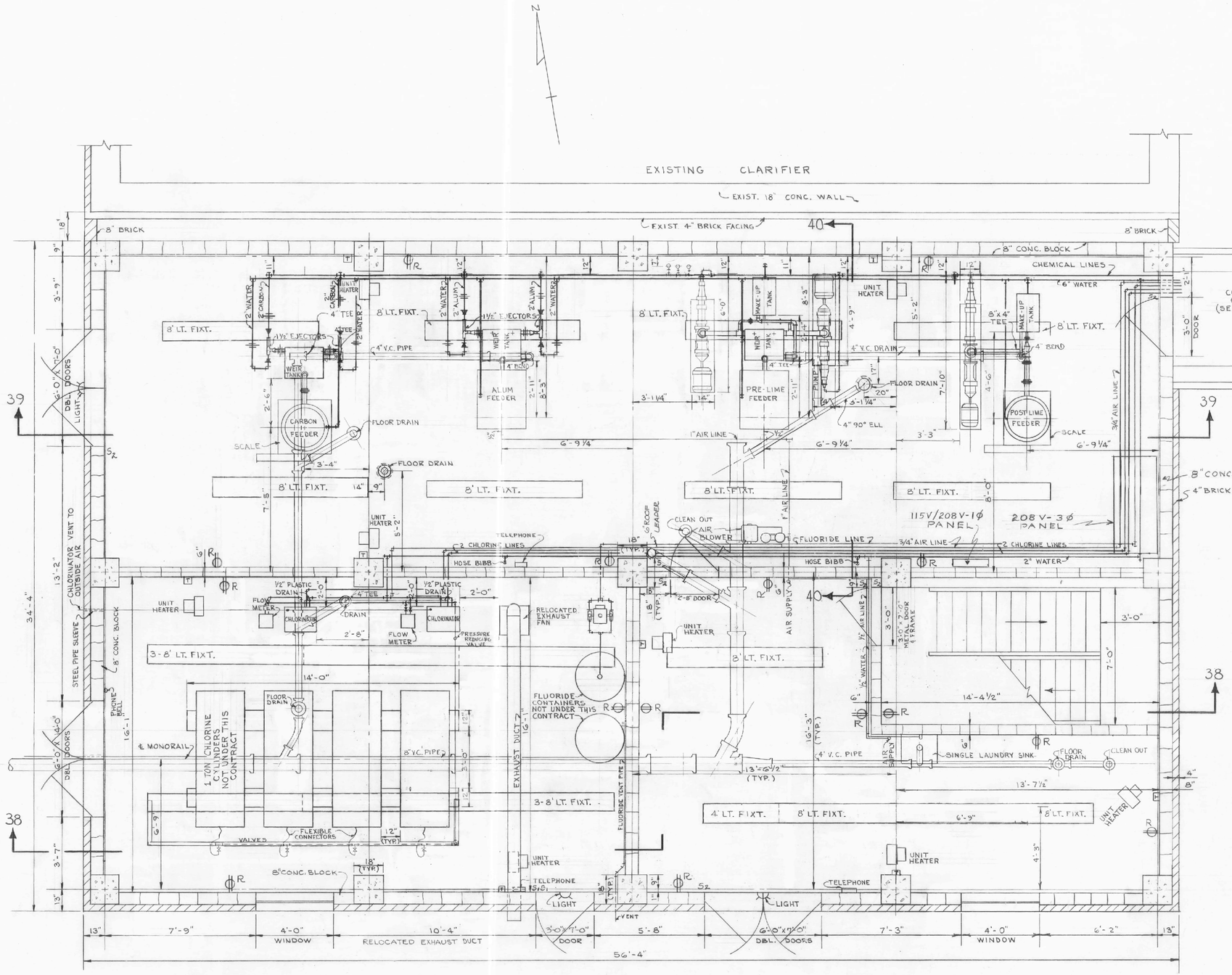
AS BUILT COMPLETED 9/10/68 DATE
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

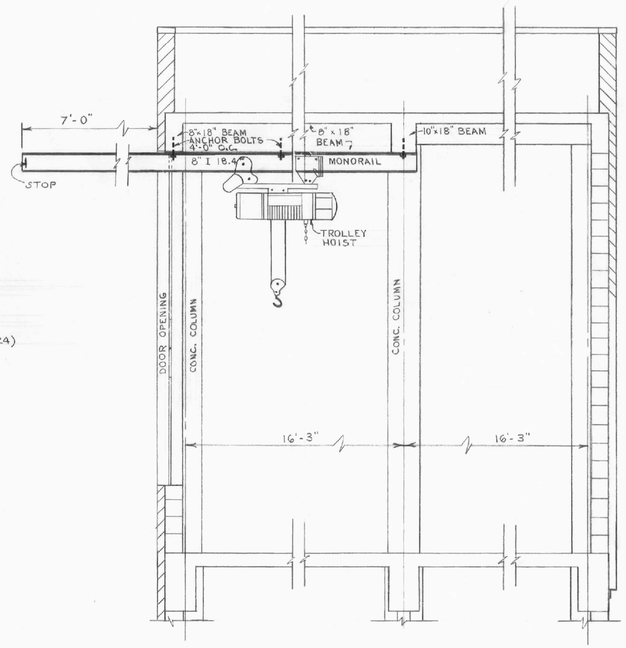
ENLARGEMENT OF WATER TREATMENT PLANT
CLARIFIER
SECTIONS AND DETAILS

DATE: DEC. 1965
JOB NO.: 65-310-W
SCALE: AS SHOWN
DRAWING NO. 19 OF 36
FILE: WTP-16

002 of 021

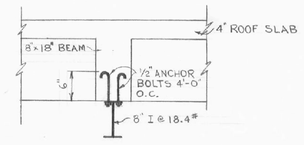


FIRST FLOOR



DETAIL OF SECOND FLOOR MONORAIL

SCALE: 3/8"= 1'-0"



DETAIL OF MONORAIL ANCHORED AT BEAM

SCALE: 3/4"= 1'-0"

Examined A. Kidd 4/16c

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED PIPING, LIGHTS HEATING & PUMPS	WRR	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED _____ DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

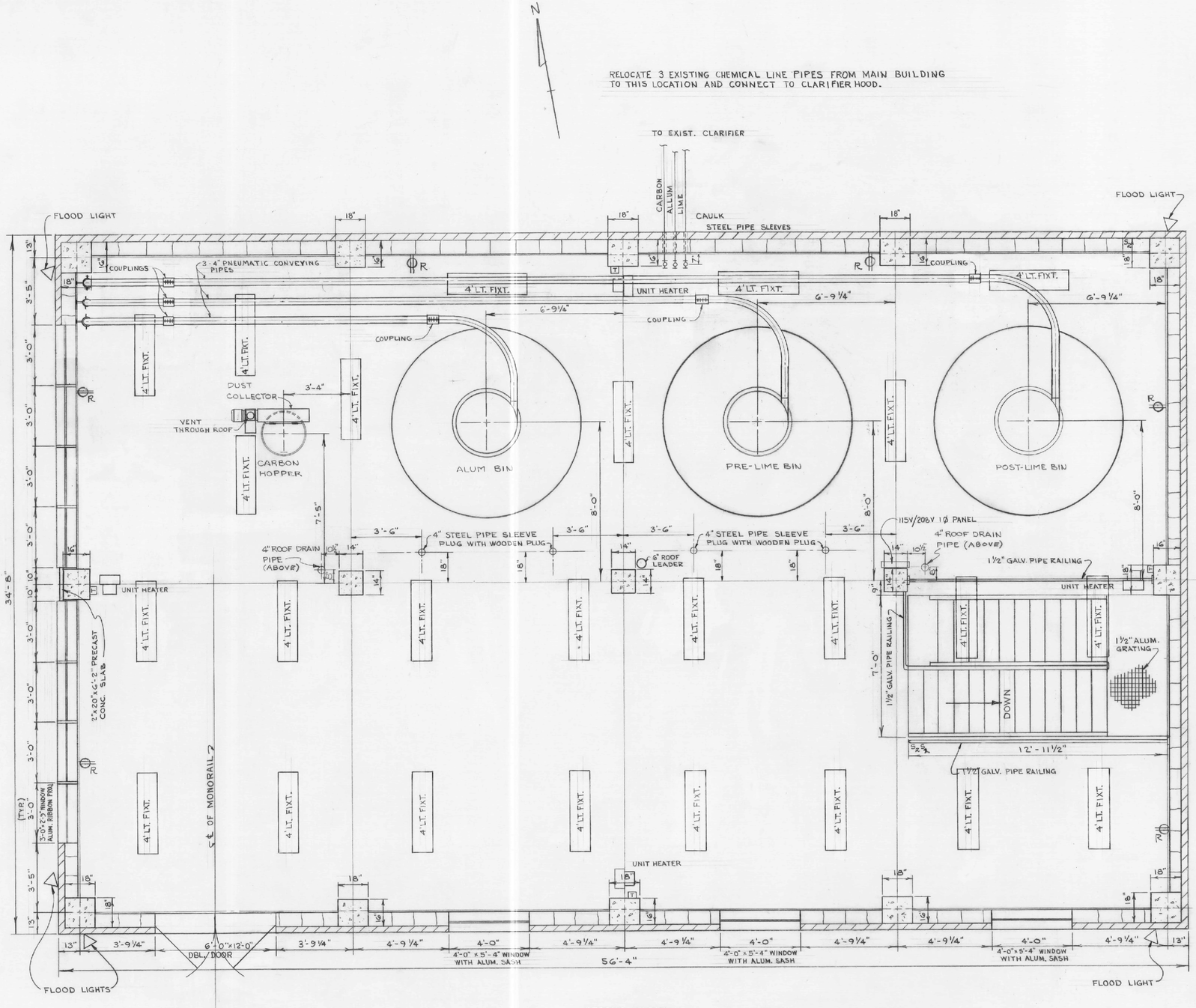
AS BUILT COMPLETED 12/22/69 DATE
William R. Moon CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

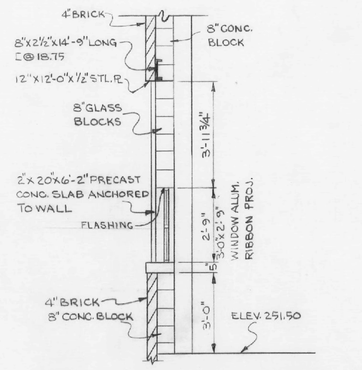
ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
PLAN

DATE: DEC. 1965
JOB NO. 65-310-W
SCALE: 3/8"= 1'-0"
DRAWING NO. 20 OF 36
FILE WTP-V

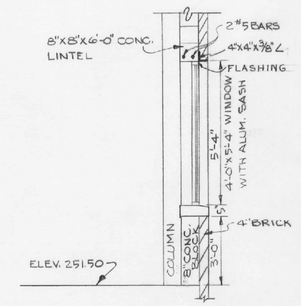
RELOCATE 3 EXISTING CHEMICAL LINE PIPES FROM MAIN BUILDING TO THIS LOCATION AND CONNECT TO CLARIFIER HOOD.



SECOND FLOOR
SCALE: 3/8"=1'-0"



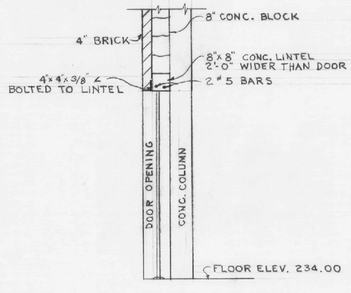
DETAIL OF WINDOW
CHEMICAL BLDG. SECOND FLOOR
SCALE: 3/8"=1'-0"



DETAIL OF WINDOW
CHEMICAL BLDG. SECOND FLOOR
SCALE: 3/8"=1'-0"

DETAIL OF CHANNEL LINTEL
SCALE: 3/4"=1'-0"

DETAIL OF WINDOW
CHEMICAL BLDG. FIRST FLOOR
SCALE: 3/8"=1'-0"



DETAIL OF DOOR OPENING
SCALE: 3/8"=1'-0"

Edward R. Kidd 2/1/68

STATE OF MARYLAND — EDWARD RAYMOND KIDD — No. 3841 — REGISTERED PROFESSIONAL ENGINEER

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	CHANGED LIGHT FIXTURES	W.R.K.	JAN. 1967

CITY OF ROCKVILLE MARYLAND

DESIGNED
TRACED
CHECKED

APPROVED 2/16/68 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

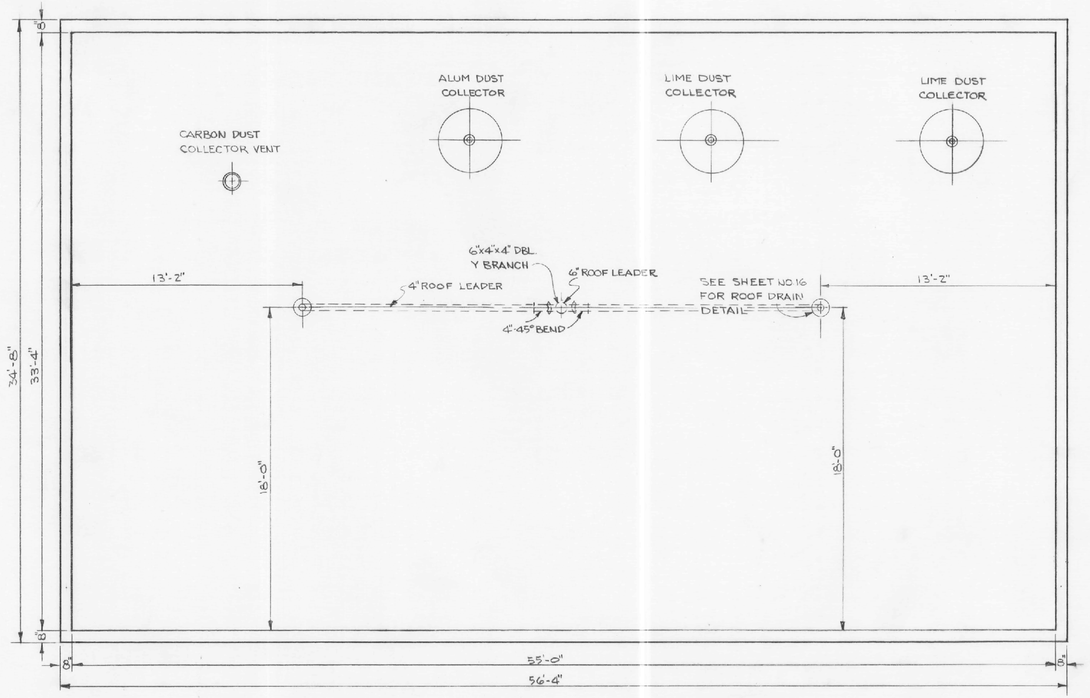
AS BUILT COMPLETED 2/10/68 DATE
William R. Moore CHIEF INSPECTOR

084 of 221

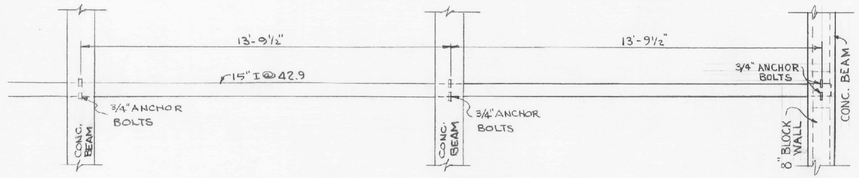
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
PLAN AND DETAILS

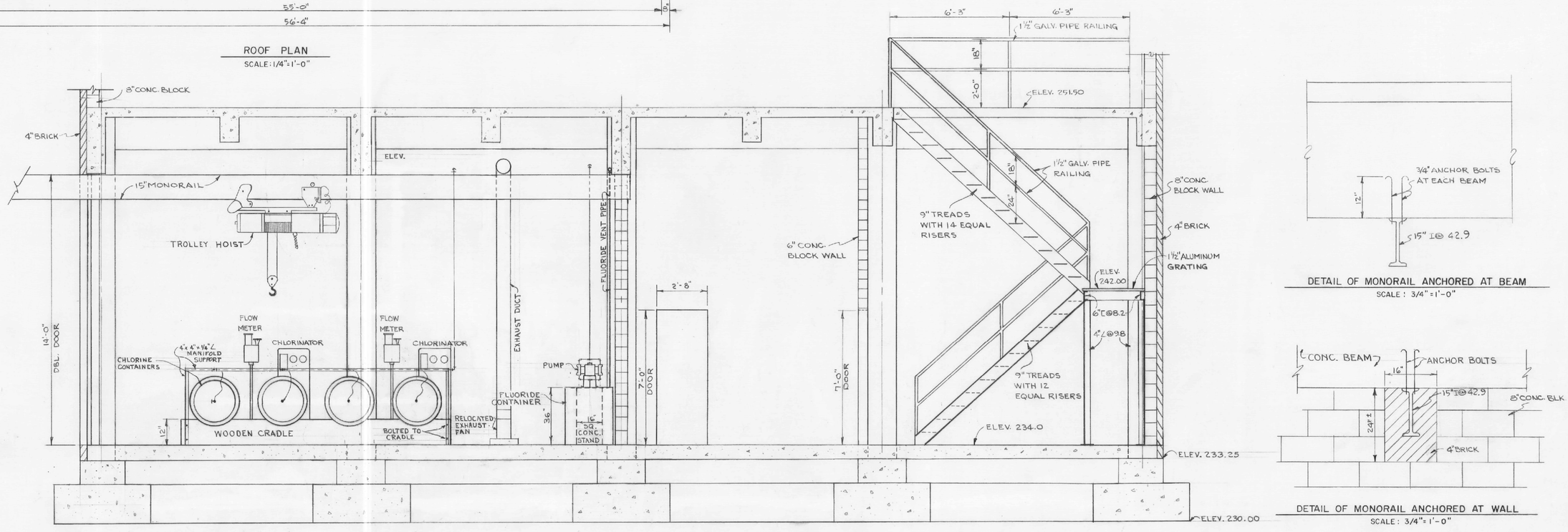
DATE DEC. 1965
JOB NO. 65-310-W
SCALE AS SHOWN
DRAWING NO. 21 OF 36
FILE WTP-16



ROOF PLAN
SCALE: 1/4"=1'-0"



DETAIL OF MONORAIL SUPPORTS
SCALE: 3/8"=1'-0"



SECTION 38-38
SCALE: 3/8"=1'-0"

DETAIL OF MONORAIL ANCHORED AT BEAM
SCALE: 3/4"=1'-0"

DETAIL OF MONORAIL ANCHORED AT WALL
SCALE: 3/4"=1'-0"

Edward A. Kidd 3/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	CHANGED FLUORIDE PUMP	[illegible]	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED [illegible] DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

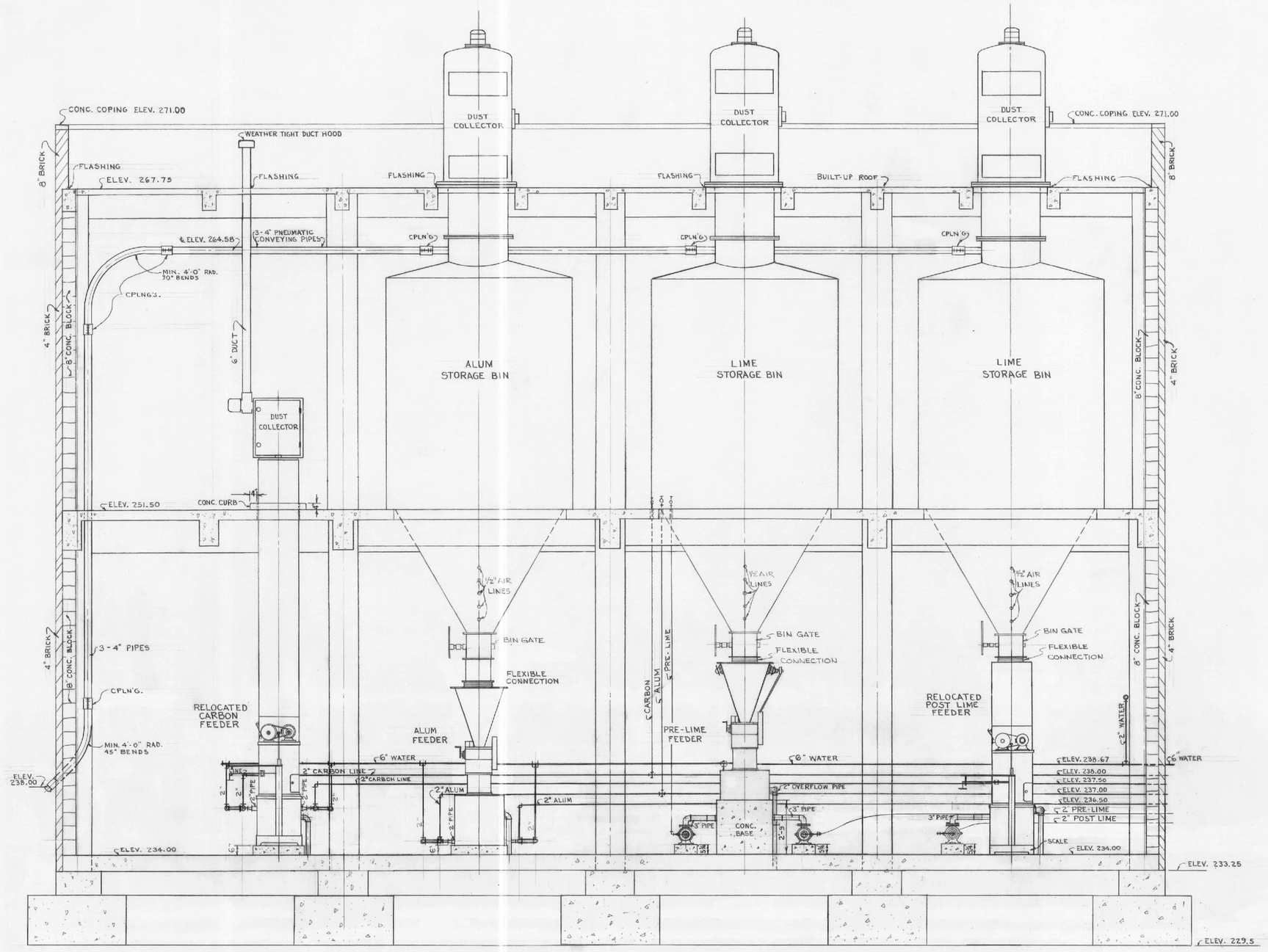
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED 9/11/69
DATE
CHIEF INSPECTOR

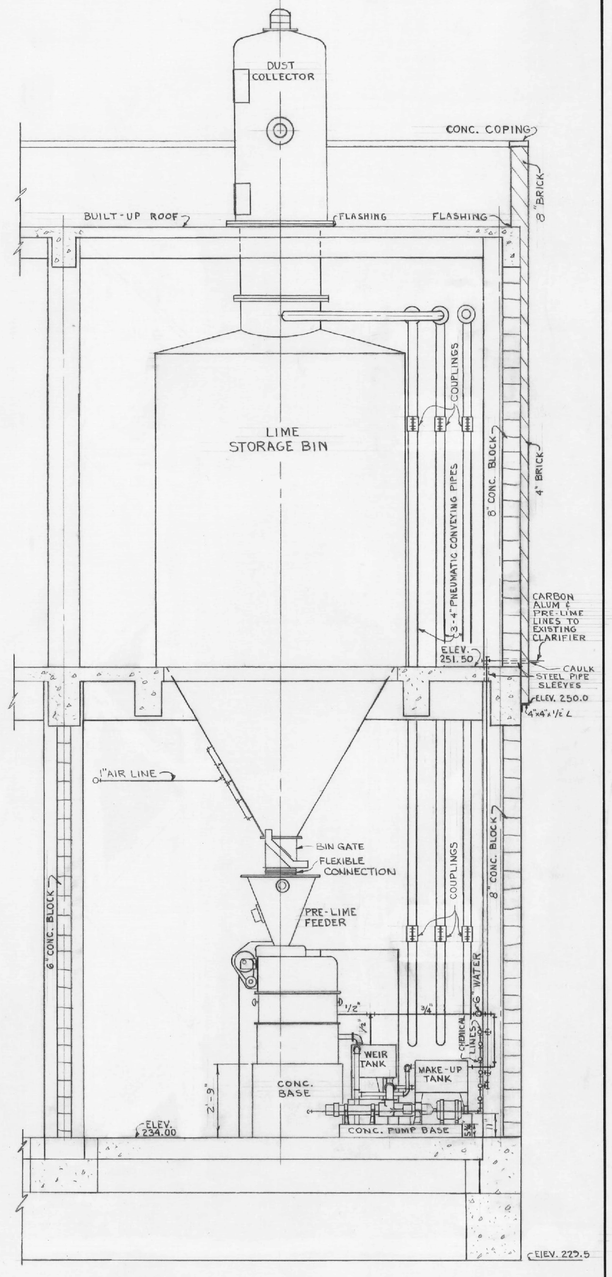
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
PLAN, SECTION AND DETAIL

DATE: DEC. 1965
JOB NO.: 65-310-W
SCALE: AS SHOWN
DRAWING NO. 22 OF 36
FILE: WTP-16



SECTION 39-39



SECTION 40-40

Edward O. Kidd 2/1/68

STATE OF MARYLAND — EDWARD ALPHONSUS KIDD — NO. 3141 — REGISTERED PROFESSIONAL ENGINEER

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT.
HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED PIPING & PUMPS	W.S.R.	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2/16/68 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

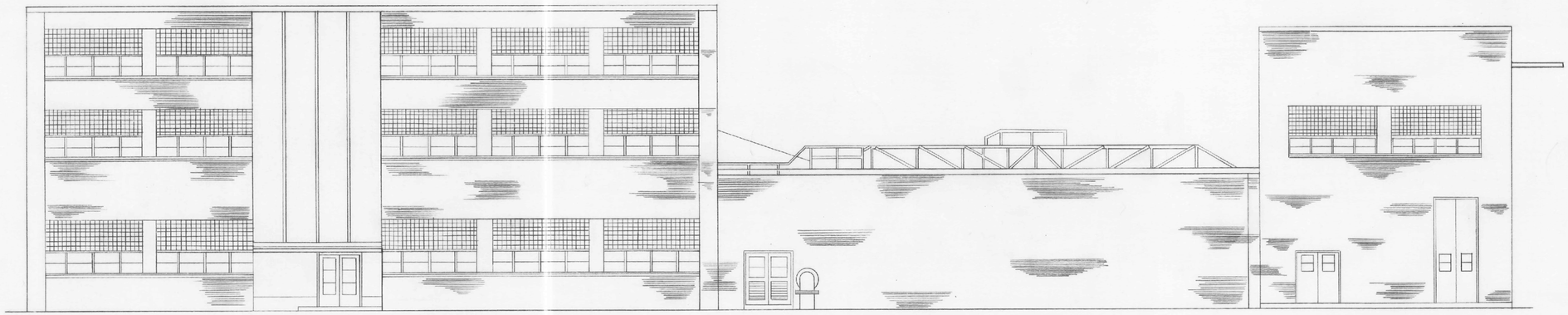
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

AS BUILT COMPLETED 9/11/69 DATE
William R. Moore CHIEF INSPECTOR

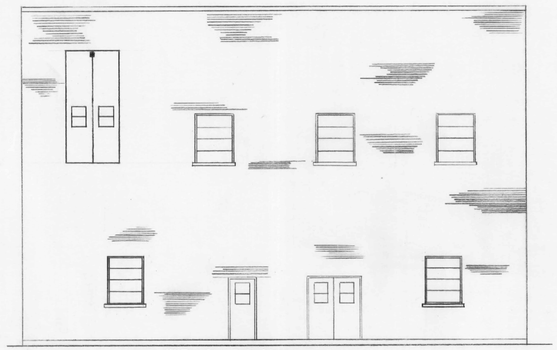
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
SECTIONS

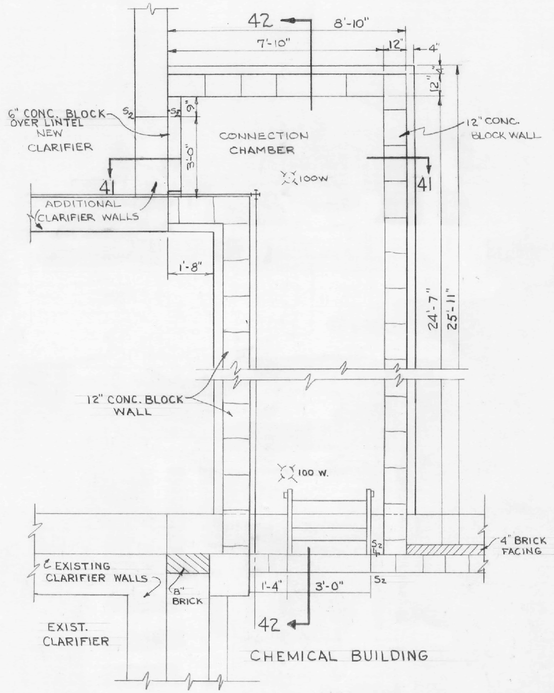
DATE: DEC. 1965
JOB NO. 65-310-W
SCALE 3/8"=1'-0"
DRAWING NO. 23 OF 36
FILE WTP-16



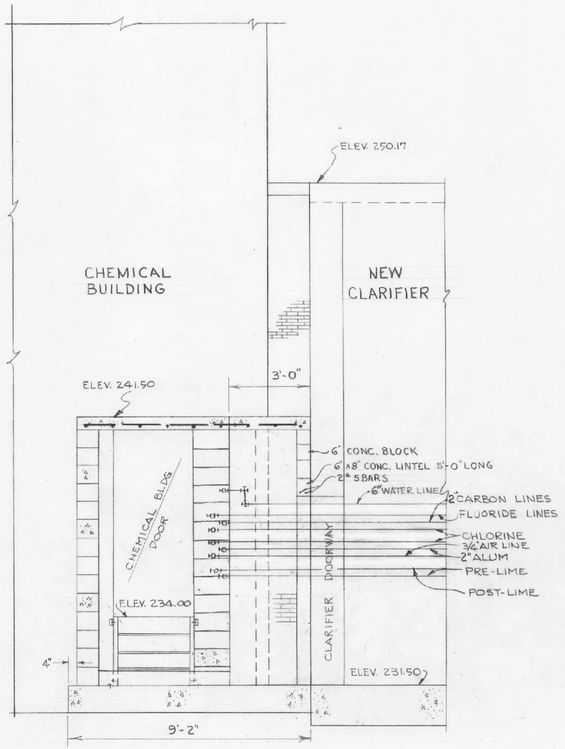
WEST ELEVATION
SCALE: 1/8"=1'-0"



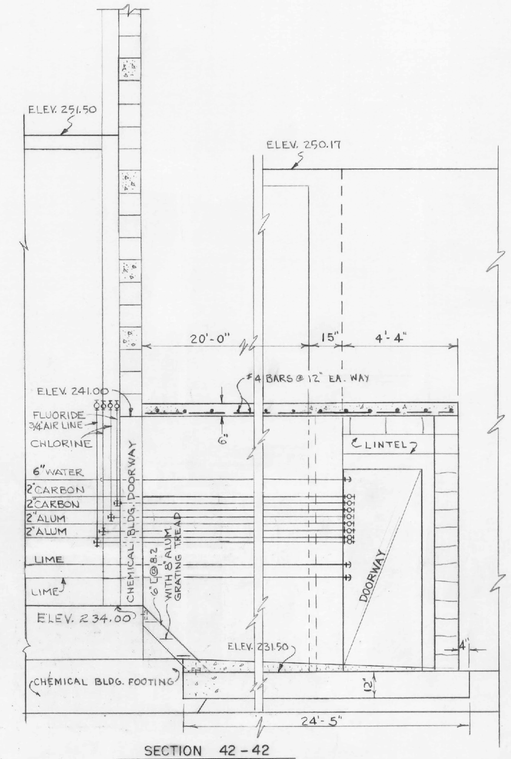
SOUTH ELEVATION
SCALE: 1/8"=1'-0"



PLAN
SCALE: 3/8"=1'-0"



SECTION 41-41
SCALE: 3/8"= 1'-0"



SECTION 42-42
SCALE: 3/8"= 1'-0"

Edward A. Riedel 2/1/66

STATE OF MARYLAND — EDWARD ALPHONSE RIEDEL — NO. 3641 — REGISTERED PROFESSIONAL ENGINEER

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-000!

NO.	REVISIONS	APP'D	DATE
1	REVISED PIPING & ELEVATIONS	WAR	JAN. 1967

DESIGNED
TRACED
CHECKED

APPROVED 2-1-66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/11/67 DATE
William R. Moon CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
ELEVATIONS, PLAN, SECTIONS AND DETAIL

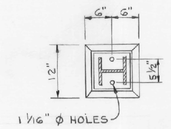
DATE: DEC. 1965
JOB NO. 65-310-W

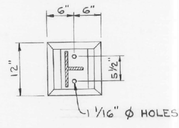
SCALE AS SHOWN

DRAWING NO. 24 OF 36

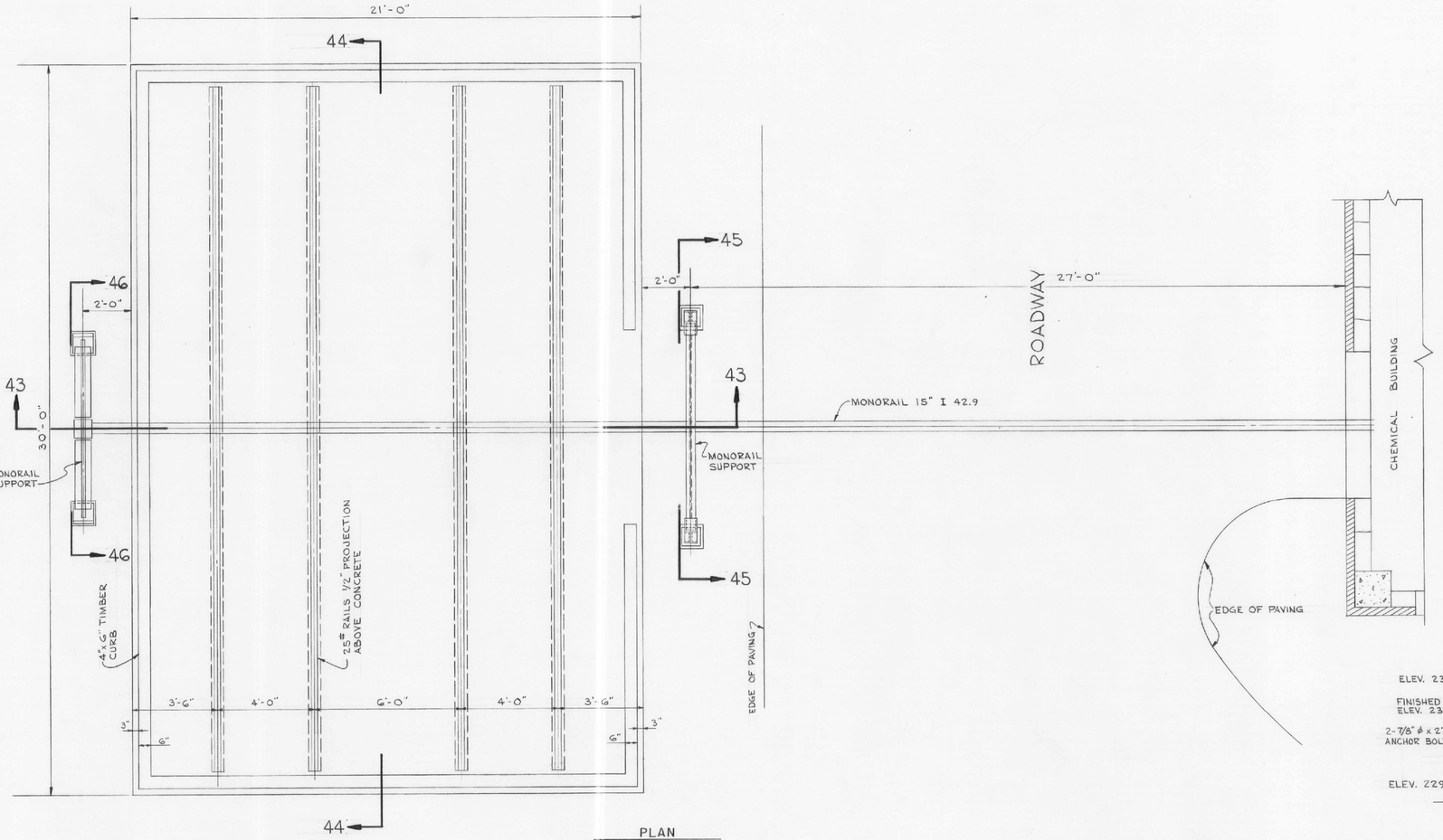
FILE WTP-1(

087 of 321

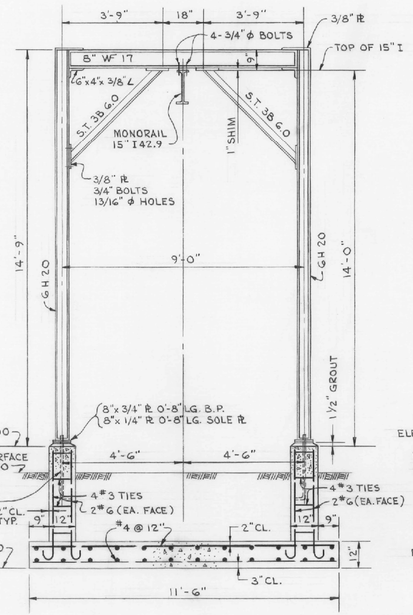




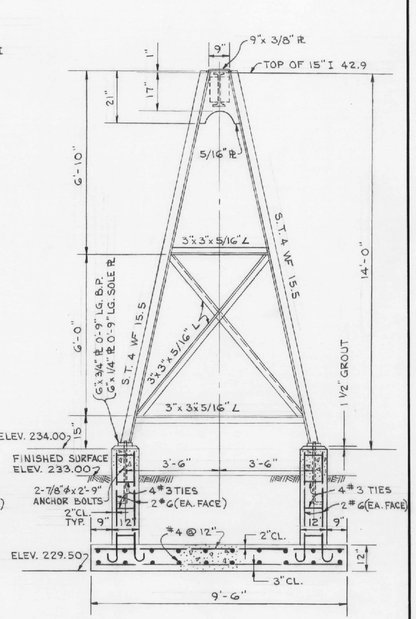
DETAILS
MONORAIL SUPPORT BASES
SCALE: 3/4"=1'-0"



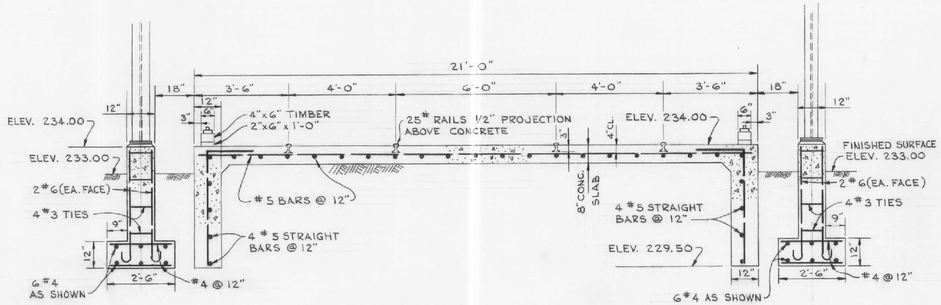
PLAN
SCALE: 3/8"=1'-0"



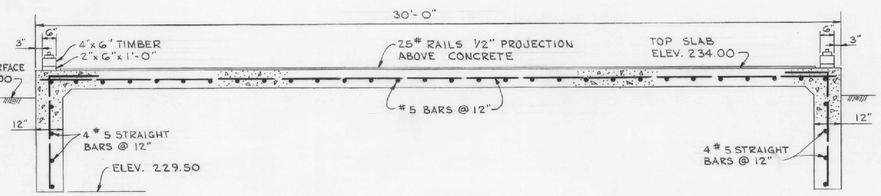
SECTION 45-45
SCALE: 3/8"=1'-0"



SECTION 46-46
SCALE: 3/8"= 1'-0"



SECTION 43-43
SCALE: 3/8"=1'-0"



SECTION 44-44
SCALE: 3/8"=1'-0"

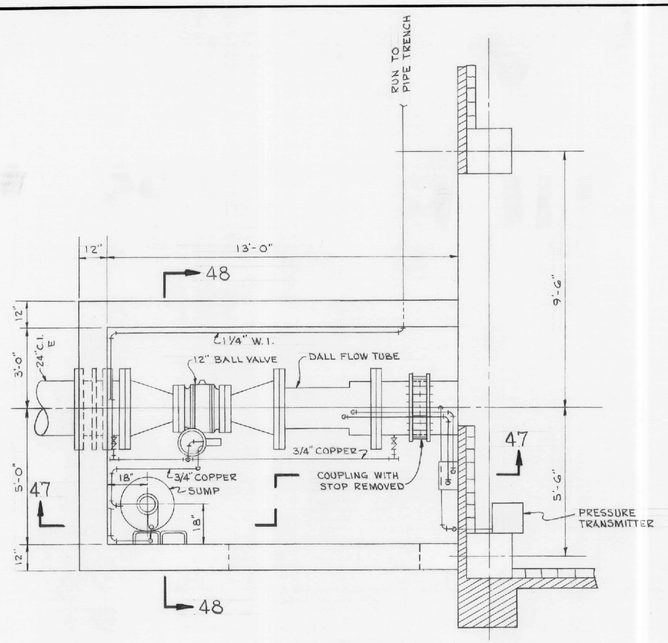
ALL WORK ON THIS DRAWING UNDER THIS CONTRACT

HUD PROJECT NO. WS-2-21-0001

Edward A. Reid 7/1/66

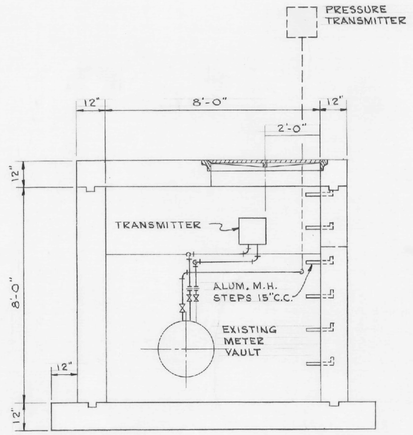
STATE OF MARYLAND
EDWARD ALPHONSUS REID
No. 3841
REGISTERED
PROFESSIONAL ENGINEER

DESIGNED	APPROVED 7/11/66 DATE	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 9/11/69 DATE	BAKER-WIBBERLEY & ASSOCIATES, INC. CONSULTING ENGINEERS HAGERSTOWN, MARYLAND	ENLARGEMENT OF WATER TREATMENT PLANT **CHLORINE STORAGE PLATFORM** PLAN, SECTIONS AND DETAILS	NO.	REVISIONS	APP'D	DATE
TRACED	DIRECTOR OF PUBLIC WORKS	PAV.		DATE PROJECT COMPLETED	CHIEF INSPECTOR			DATE DEC. 1965	SCALE AS SHOWN	DRAWING NO. 25 OF 36	FILE WTP-16
CHECKED		SD		DATE ACCEPTED BY CITY				JOB NO. 65-310-W			
		W		DATE TRANS. TO FINANCE DEPT., W/R 9 FORM							
		S									
		OTHER									



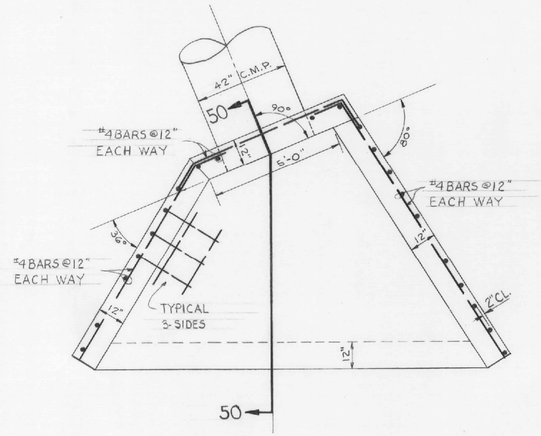
PLAN OF EXIST. METER VAULT

SCALE: 3/8"= 1'-0"



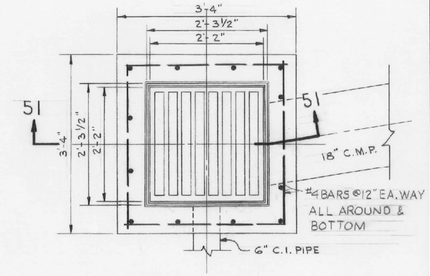
SECTION 48-48

SCALE: 3/8"=1'-0"



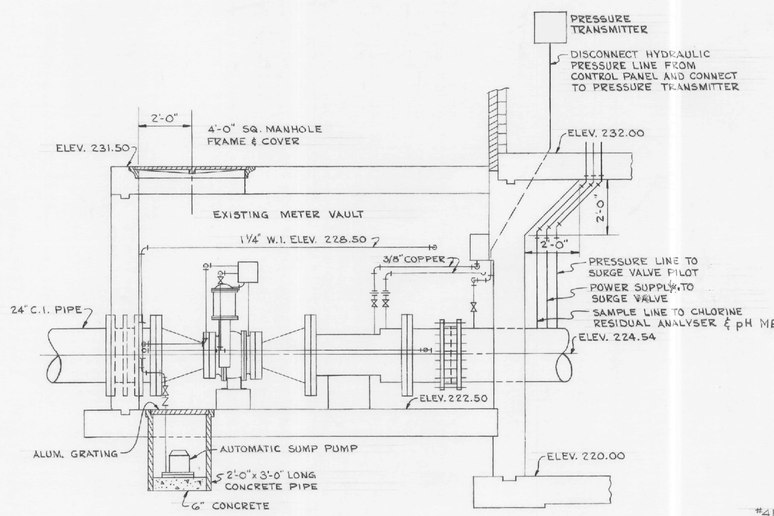
PLAN OF HEADWALL

SCALE: 3/8"=1'-0"



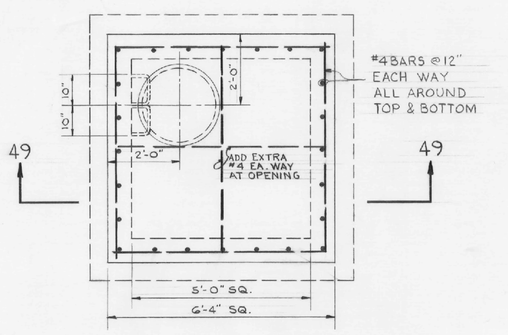
PLAN OF INLET

SCALE: 3/4"=1'-0"



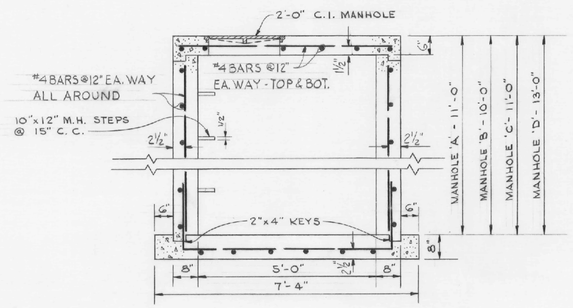
SECTION 47 - 47

SCALE: 3/8"=1'-0"



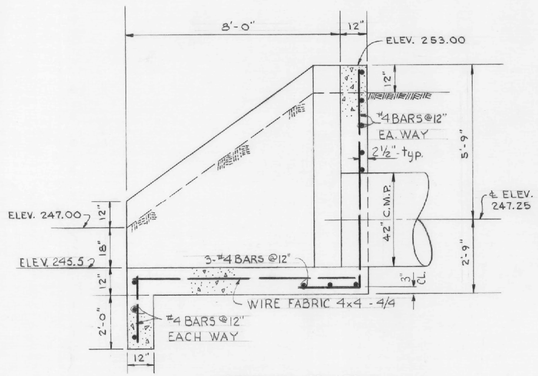
PLAN OF MANHOLE

SCALE: 1/2"=1'-0"



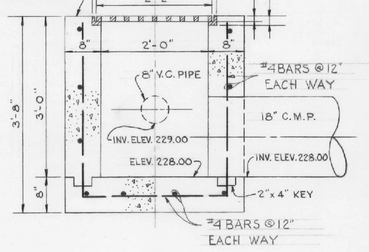
SECTION 49-49

SCALE: 1/2"=1'-0"



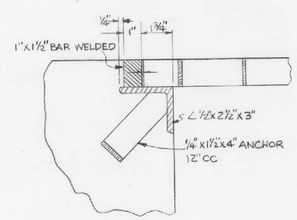
SECTION 50 - 50

SCALE: 3/8"=1'-0"



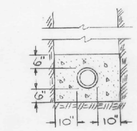
SECTION 51-51

SCALE: 3/4"=1'-0"



DETAIL
GRATING FRAME

SCALE: 3"=1'-0"



DETAIL
CONC. ENCASEMENT

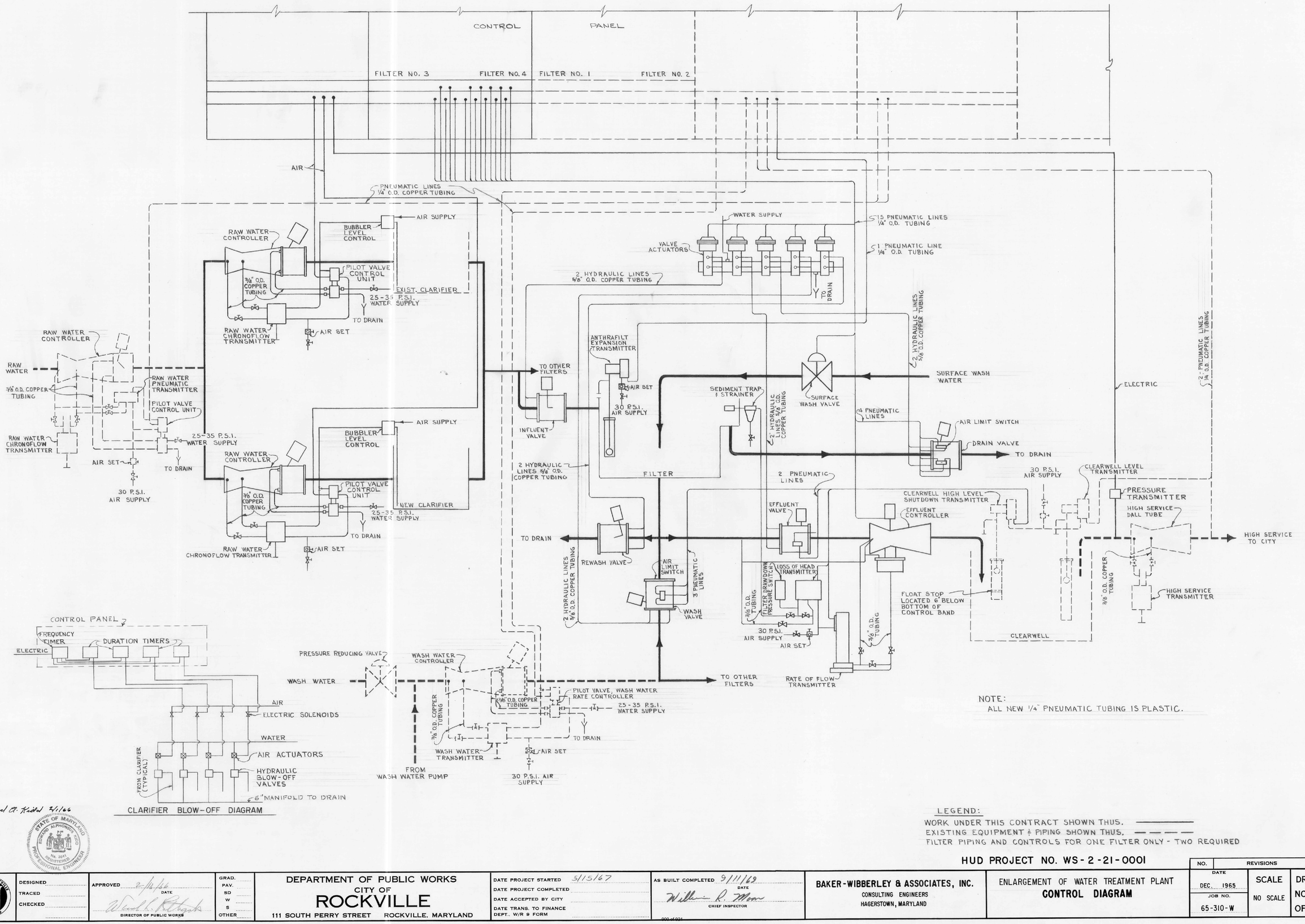
SCALE: 3/8"=1'-0"

Edward A. Tridel 2/1/66

ALL WORK ON THIS DRAWING UNDER THIS CONTRACT EXCEPT AS NOTED

HUD PROJECT NO. WS-2-21-0001

DESIGNED	APPROVED 2/16/66 DATE	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 9/11/69 DATE	BAKER-WIBBERLEY & ASSOCIATES, INC. CONSULTING ENGINEERS HAGERSTOWN, MARYLAND	ENLARGEMENT OF WATER TREATMENT PLANT **MISCELLANEOUS DETAILS**	NO.	REVISIONS	APP'D	DATE
TRACED	DIRECTOR OF PUBLIC WORKS	PAV.		DATE PROJECT COMPLETED	CHIEF INSPECTOR			DATE			
CHECKED		SD		DATE ACCEPTED BY CITY				DEC. 1965			
		W		DATE TRANS. TO FINANCE DEPT., W/R 9 FORM				JOB NO. 65-310-W	SCALE AS SHOWN	DRAWING NO. 26 OF 36	FILE WTR-16
		S									
		OTHER									



NOTE:
ALL NEW 1/4" PNEUMATIC TUBING IS PLASTIC.

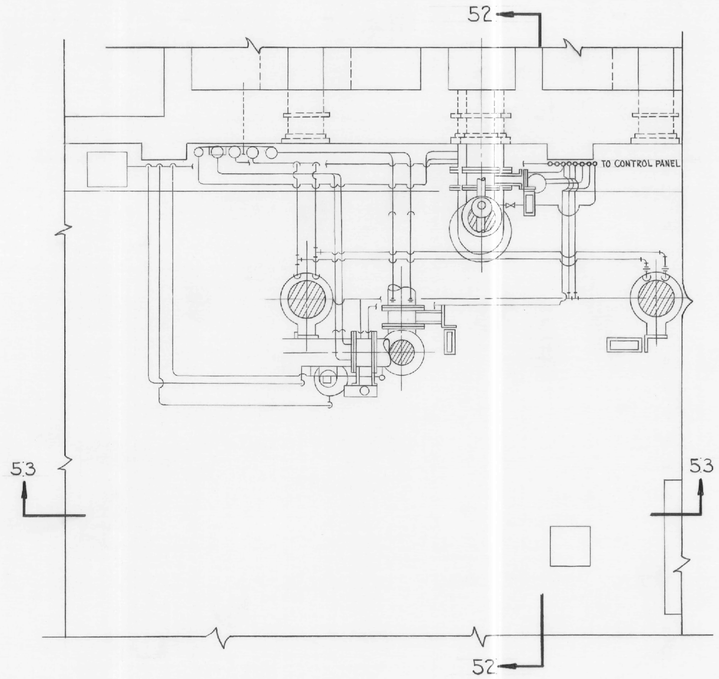
LEGEND:
WORK UNDER THIS CONTRACT SHOWN THUS. ————
EXISTING EQUIPMENT & PIPING SHOWN THUS. — — — —
FILTER PIPING AND CONTROLS FOR ONE FILTER ONLY - TWO REQUIRED

Edward A. Kreital 3/1/66

HUD PROJECT NO. WS-2-21-0001

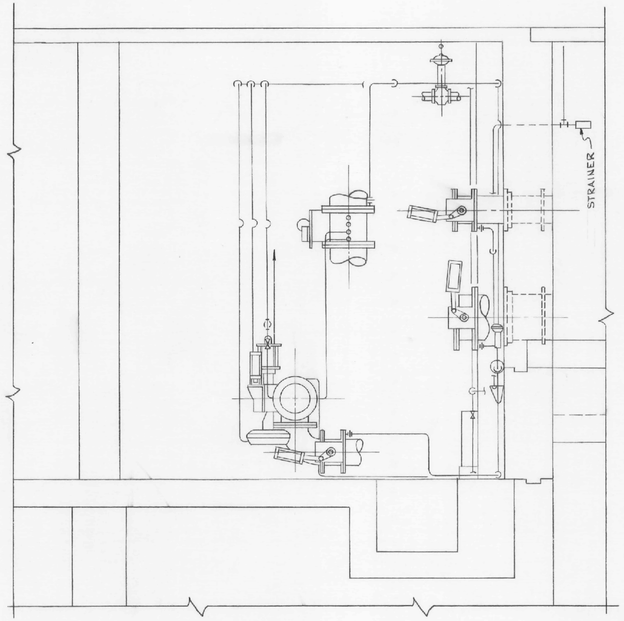
DESIGNED	APPROVED	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 9/11/69	BAKER-WIBBERLEY & ASSOCIATES, INC. CONSULTING ENGINEERS HAGERSTOWN, MARYLAND	ENLARGEMENT OF WATER TREATMENT PLANT CONTROL DIAGRAM	NO.	REVISIONS	APP'D	DATE
TRACED	DATE	PAV.		DATE PROJECT COMPLETED	DATE				DATE		
CHECKED	DIRECTOR OF PUBLIC WORKS	SD		DATE ACCEPTED BY CITY	CHIEF INSPECTOR				DEC. 1965	SCALE	DRAWING
		W		DATE TRANS. TO FINANCE DEPT., W/R 9 FORM					JOB NO.	NO SCALE	NO. 27
		S							65-310-W		OF 36
		OTHER									FILE WTP-16

000 of 021



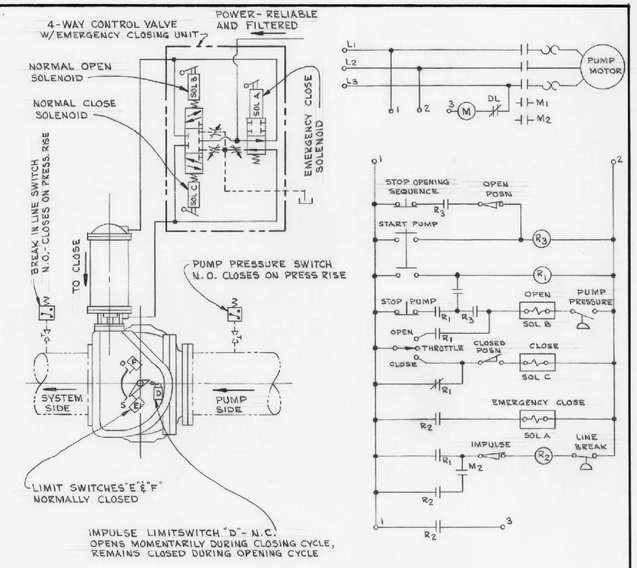
PLAN OF FILTER CONTROL PIPING

SCALE: 3/8"=1'-0"



SECTION 52-52

SCALE: 3/8"=1'-0"

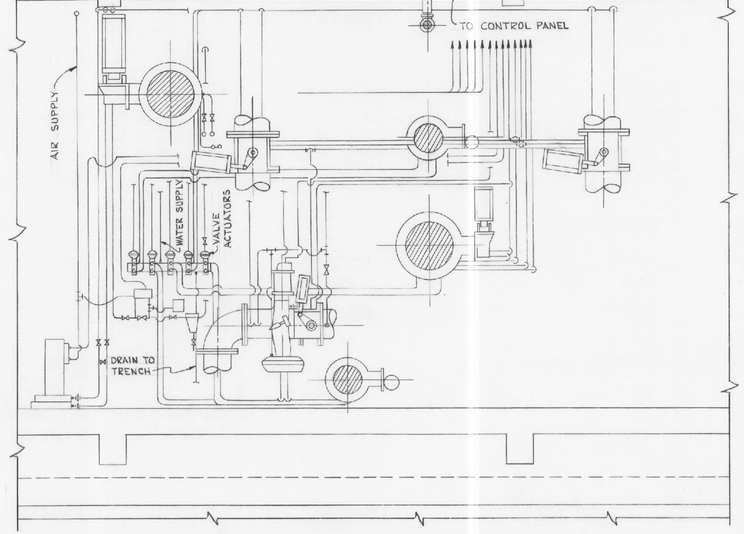


THROTTLING BALL VALVE CONTROL DIAGRAM

SCALE: NO SCALE

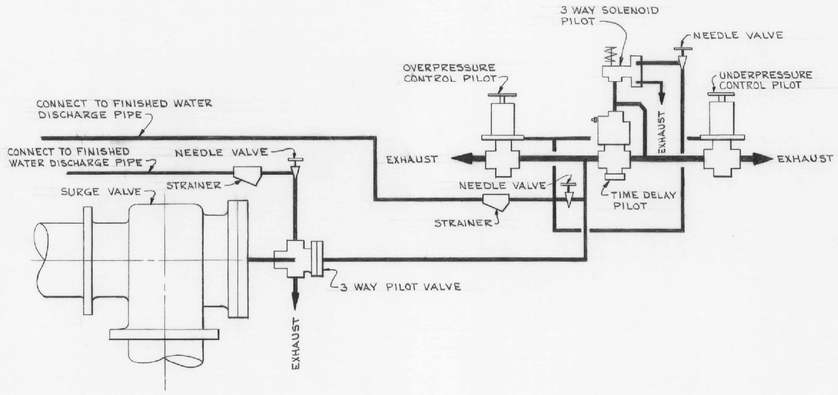
CHLORINE CONTROL DIAGRAM

SCALE: NO SCALE



SECTION 53-53

SCALE: 3/8"=1'-0"



SURGE VALVE CONTROL DIAGRAM

SCALE: NO SCALE

Edward A. Hirtf 3/1/66

STATE OF MARYLAND EDWARD ALPHONSE HIRTF No. 3641 REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

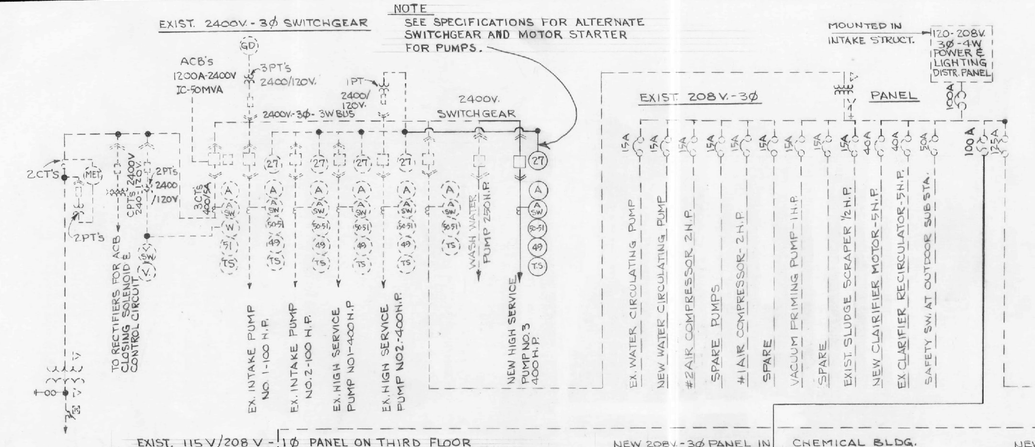
DESIGNED	APPROVED 3/1/66 DATE	GRAD.	DEPARTMENT OF PUBLIC WORKS CITY OF ROCKVILLE 111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE PROJECT STARTED 5/15/67	AS BUILT COMPLETED 3/11/69 DATE
TRACED		PAV.		DATE PROJECT COMPLETED	
CHECKED	DIRECTOR OF PUBLIC WORKS	SD		DATE ACCEPTED BY CITY	CHIEF INSPECTOR
		W		DATE TRANS. TO FINANCE DEPT., W/R & FORM	
		S			
		OTHER			

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CONTROL PIPING AND DETAILS
PLAN, SECTIONS AND DIAGRAMS

DATE	SCALE	DRAWING	FILE
DEC. 1965	AS SHOWN	NO. 28	WTP-1
JOB NO. 65-310-W		OF 36	

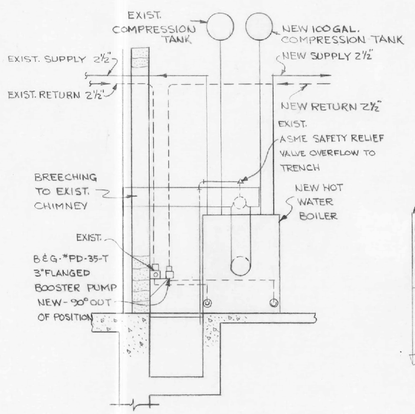
501 of 921



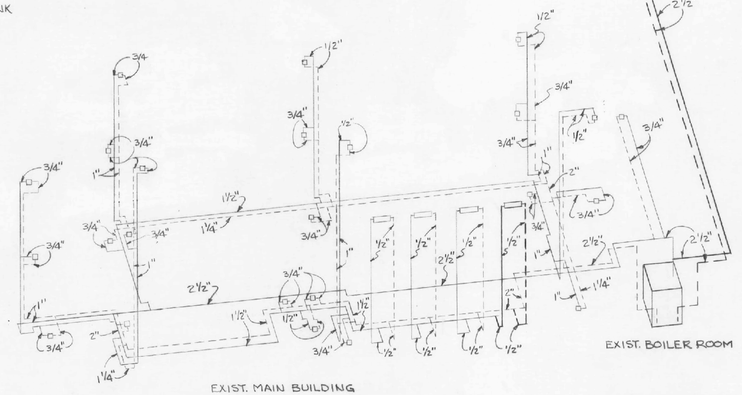
ELECTRICAL WIRING DIAGRAM

LEGEND

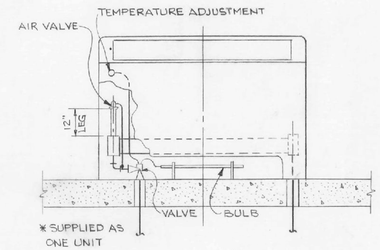
A- AMMETER
A-SW-AMMETER SWITCH
50-51-OVERCURRENT RELAYS(3) WITH INSTANTANEOUS TRIPS
49- THERMAL RELAY
TS- TEST SWITCH
27- UNDERVOLTAGE RELAY



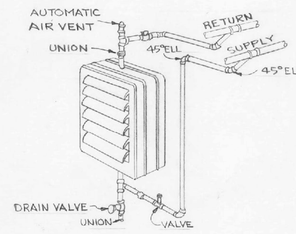
BOILER PIPING



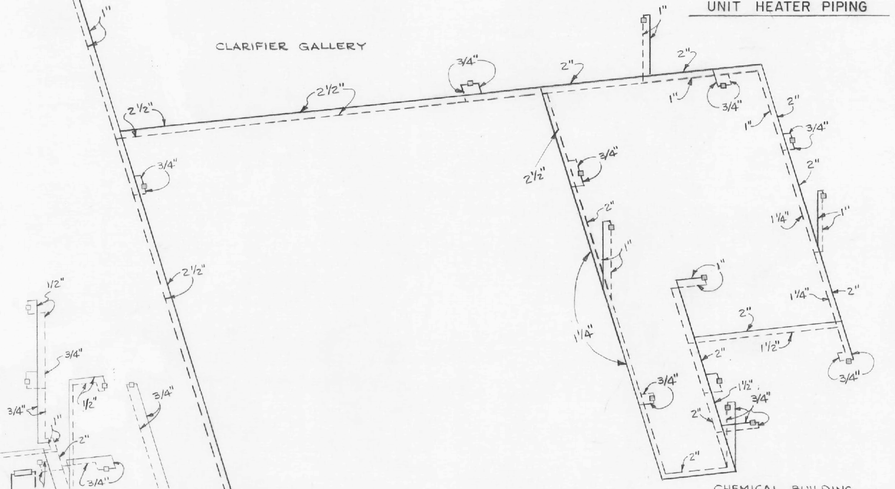
HEATING SYSTEM



CONVECTOR PIPING



UNIT HEATER PIPING



Edward A. Riddel 3/1/66

STATE OF MARYLAND · EDWARD A. PHOENIX RIDDEL · REG. 3641 · REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	ELECTRICAL & HEATING DIA'S.	WRR	JAN. 1967

DESIGNED
TRACED
CHECKED
APPROVED 2 Jan 1968 DATE
W. C. Rothgeb DIRECTOR OF PUBLIC WORKS
GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

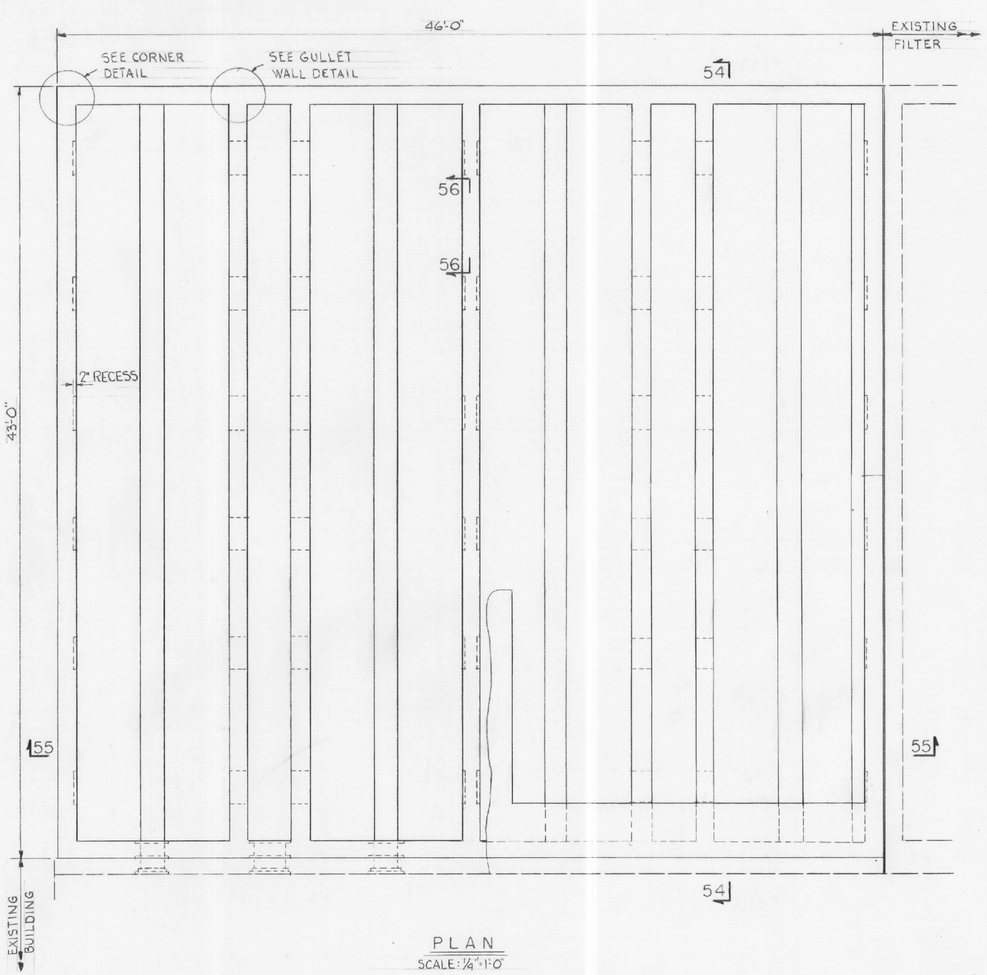
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/17/69 DATE
William R Moon CHIEF INSPECTOR

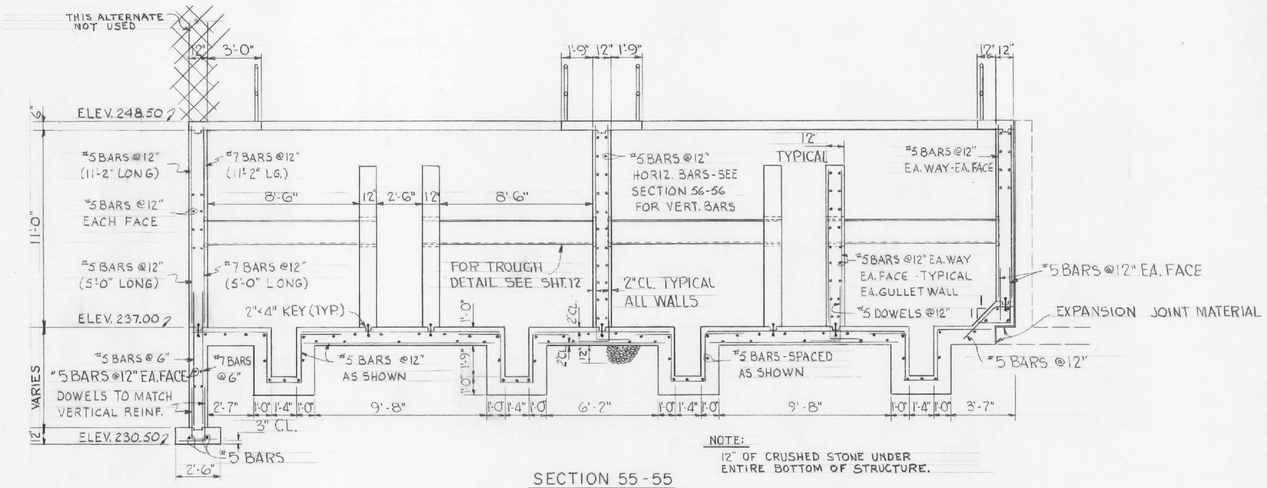
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
ELECTRICAL AND HEATING DIAGRAMS

DATE DEC. 1965
JOB NO. 65-310-W
SCALE NO SCALE
DRAWING NO. 29 OF 36
FILE WTP-16

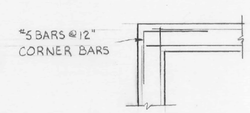


PLAN
SCALE: 1/4" = 1'-0"

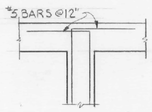


SECTION 55-55
SCALE: 1/4" = 1'-0"

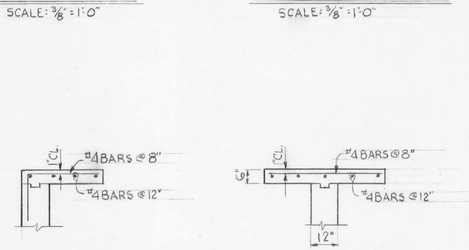
NOTE:
12" OF CRUSHED STONE UNDER ENTIRE BOTTOM OF STRUCTURE.



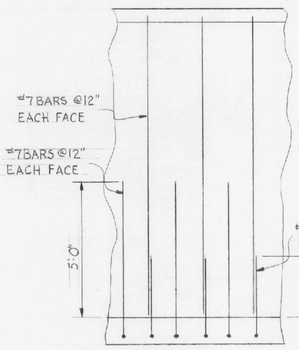
CORNER DETAIL
SCALE: 3/8" = 1'-0"



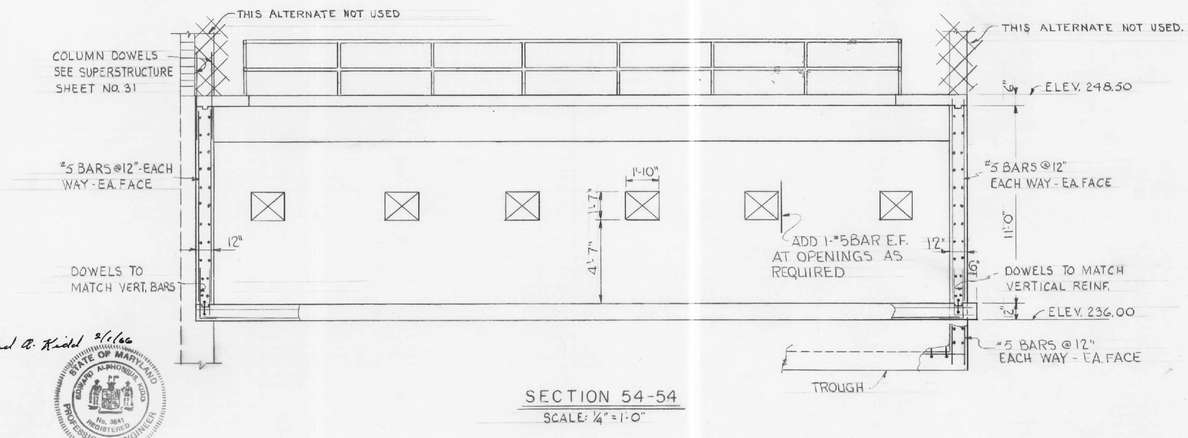
GULLET WALL DETAIL
SCALE: 3/8" = 1'-0"



WALK SLAB DETAILS
SCALE: 3/8" = 1'-0"



SECTION 56-56
SCALE: 3/8" = 1'-0"



SECTION 54-54
SCALE: 1/4" = 1'-0"

Edward A. Riedel 2/14/66
STATE OF MARYLAND EDWARD ALPHONSUS RIEDEL No. 3641 REGISTERED PROFESSIONAL ENGINEER

GENERAL NOTES:

ALL CONCRETE TO HAVE 3,000 P.S.I. COMPRESSIVE STRENGTH.

ALL REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A-305.

SEE MECHANICAL DRAWINGS FOR DETAILS NOT SHOWN ON STRUCTURAL PLANS.

MINIMUM LAP SHALL BE 30 BAR DIAMETERS.

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

DESIGNED
TRACED
CHECKED

APPROVED 2/14/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 3/11/69 DATE
CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

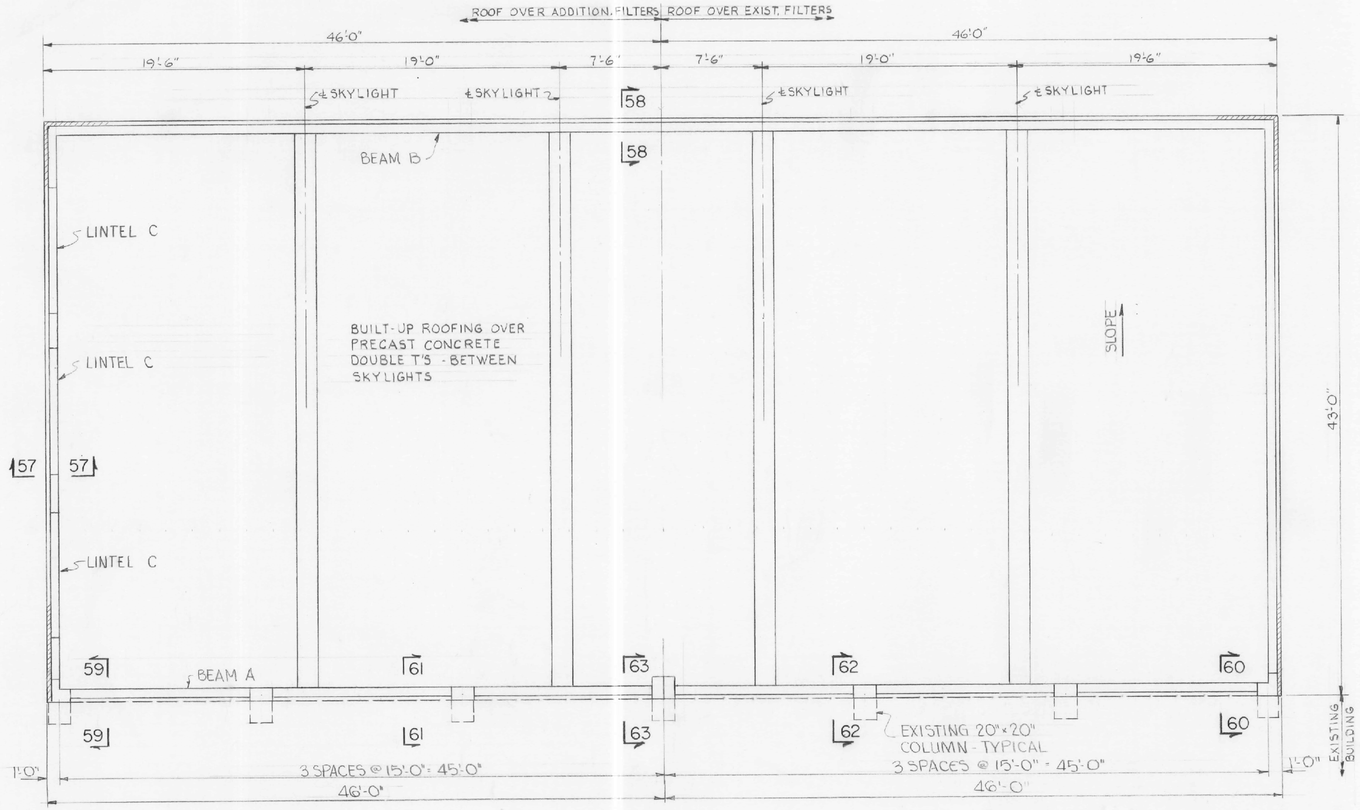
ENLARGEMENT OF WATER TREATMENT PLANT
ADDITIONAL FILTERS
STRUCTURAL DETAILS

DATE DEC. 1965
JOB NO. 65-310-W

SCALE AS NOTED

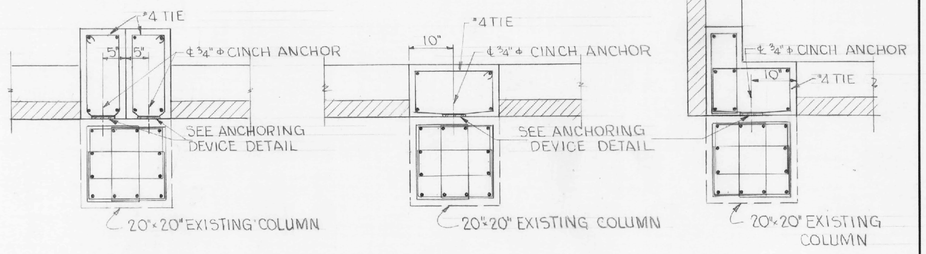
DRAWING NO. 30 OF 36

FILE WTP-16



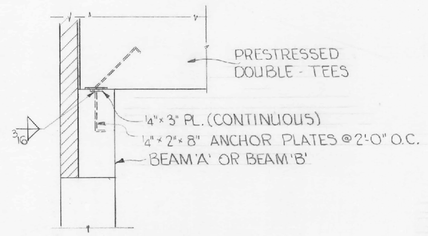
PLAN

SCALE: 1/16"=1'-0"



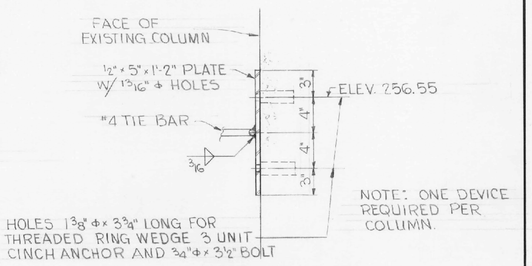
SECTION 66-66 | SECTION 65-65 | SECTION 64-64

SCALE: 3/4" = 1'-0"



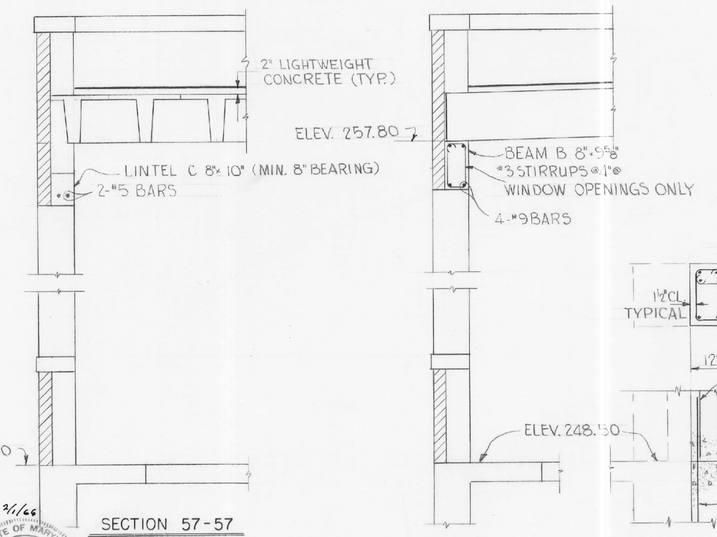
TYPICAL ROOF CONNECTION DETAIL

SCALE: 3/4" = 1'-0"



ANCHORING DEVICE DETAIL

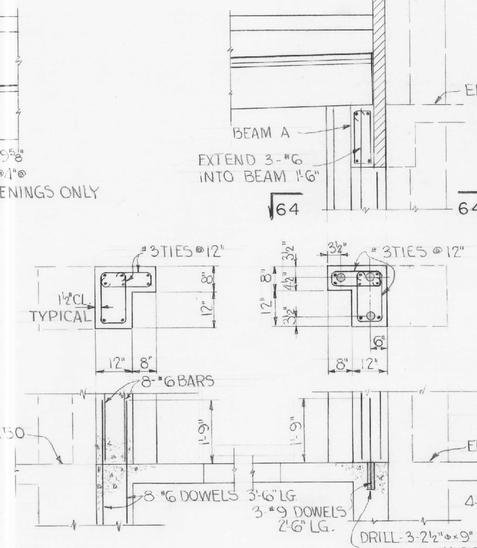
SCALE: 1 1/2" = 1'-0"



Edward A. Riddel 3/1/66

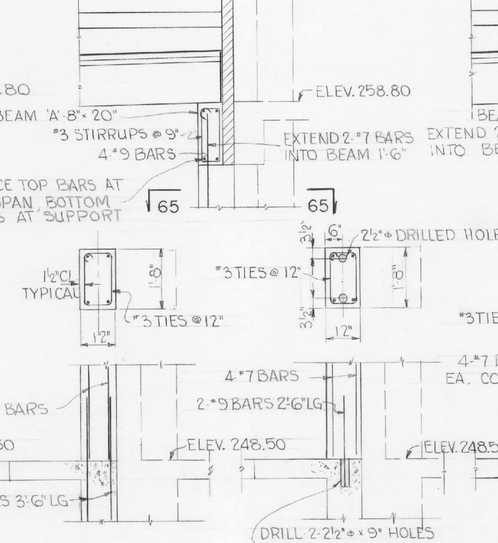
SECTION 57-57

SECTION 58-58

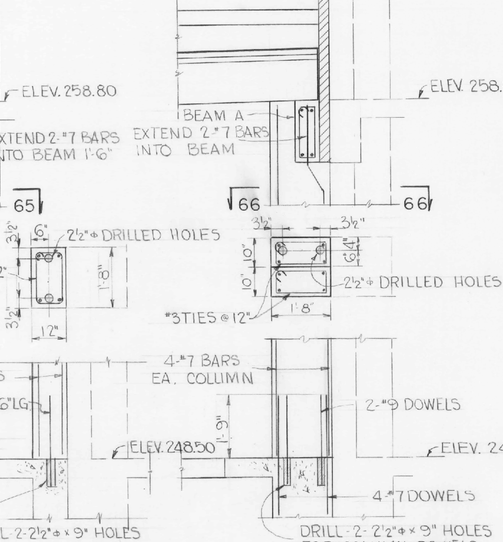


SECTION 59-59

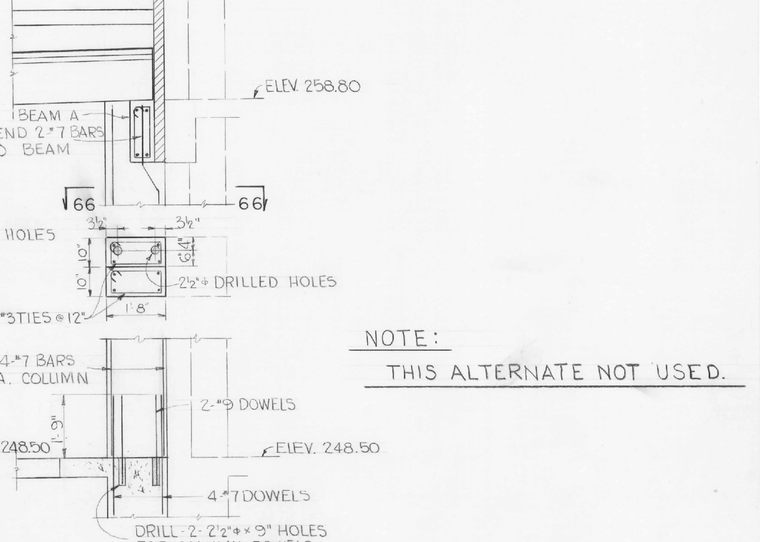
SECTION 60-60



SECTION 61-61



SECTION 62-62



SECTION 63-63

SCALE: 1/2" = 1'-0"

NOTE:

THIS ALTERNATE NOT USED.

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

DESIGNED | TRACED | CHECKED

APPROVED 2/16/66 DATE

W. Wood Director of Public Works DIRECTOR OF PUBLIC WORKS

GRAD. | PAV. | SD. | W | S | OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

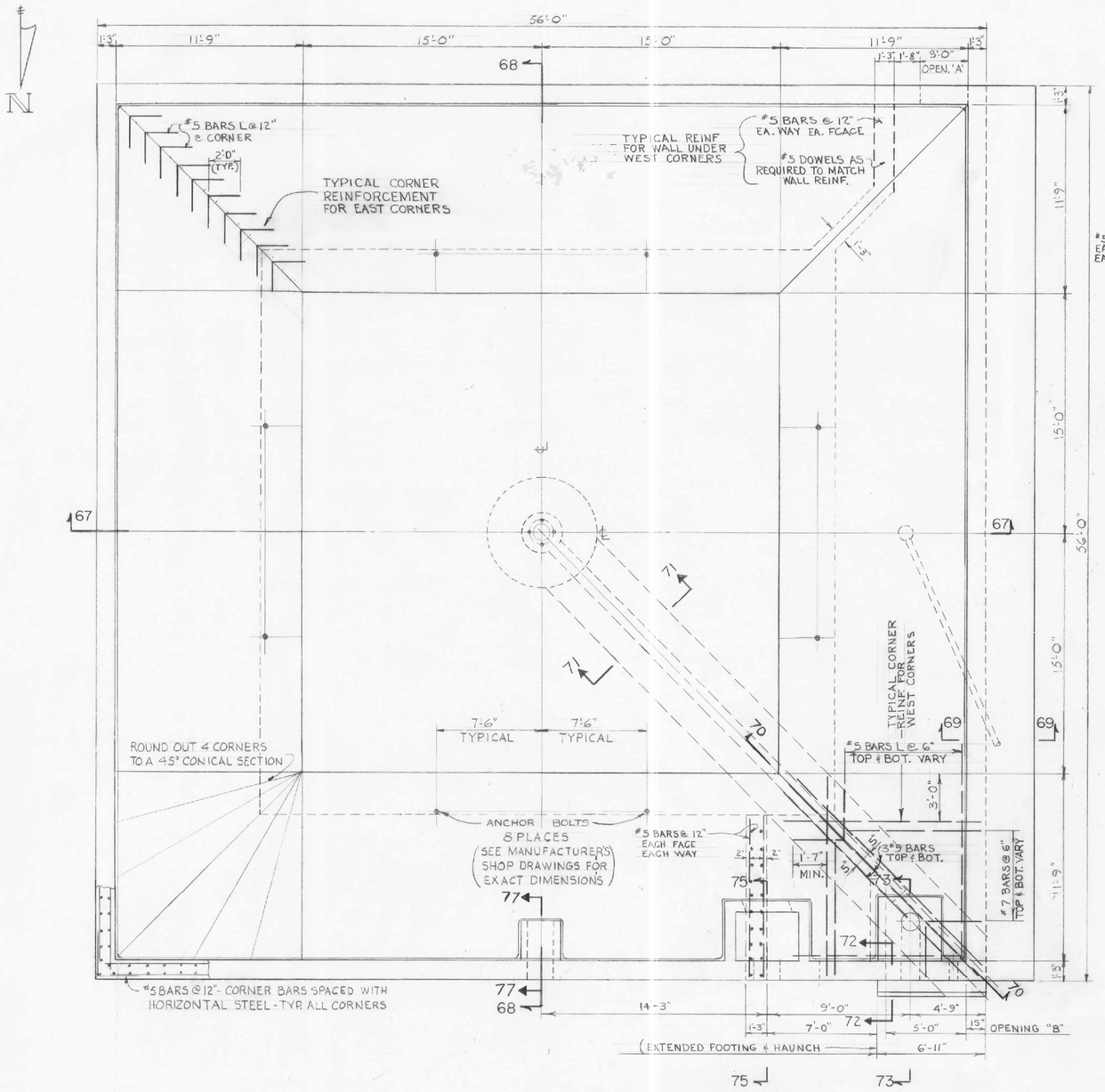
DATE PROJECT STARTED
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED DATE
CHIEF INSPECTOR

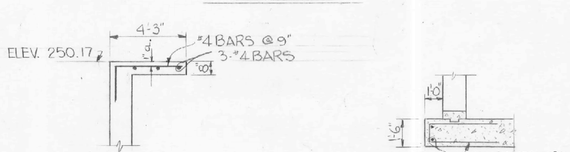
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
FILTER SUPERSTRUCTURE
STRUCTURAL DETAILS

DATE DEC. 1965
JOB NO. 65-310-W
SCALE AS NOTED
DRAWING NO. 31 OF 36
FILE WTP-16

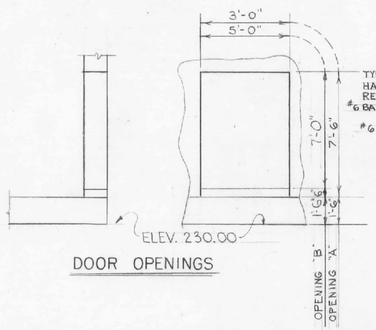


PLAN

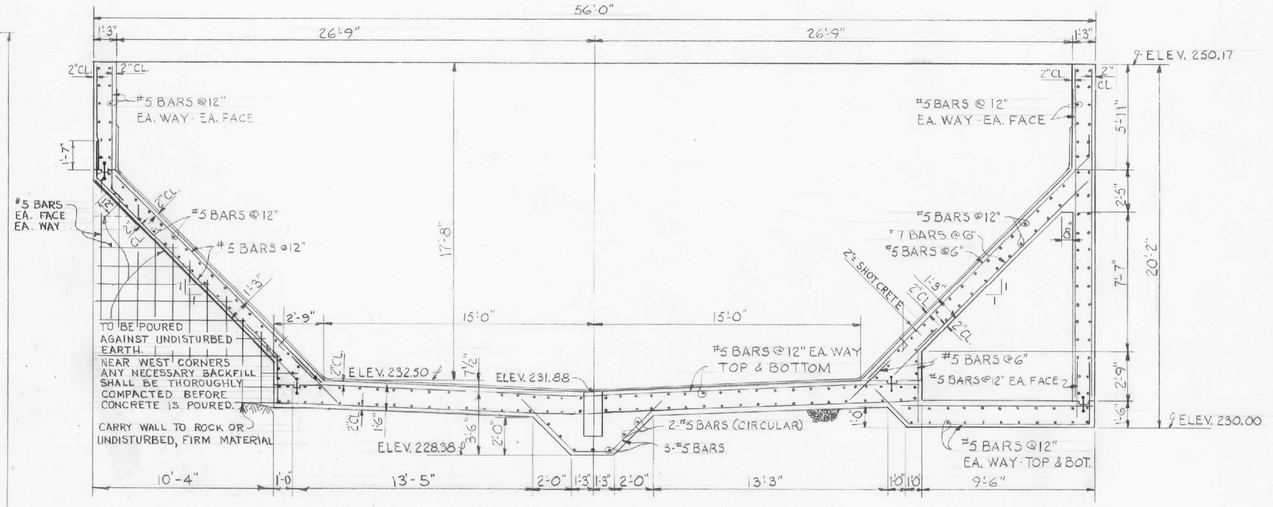


SECTION 69-69

SECTION 72-72

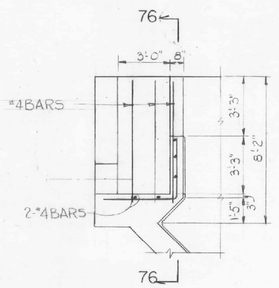


DOOR OPENINGS

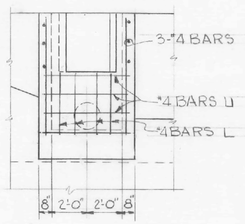


SECTION 67-67

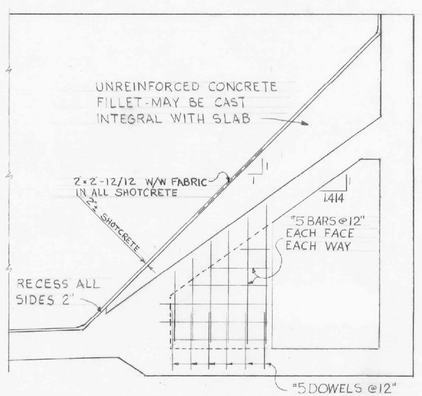
REINFORCING IN SECTION 68-68 SIMILAR



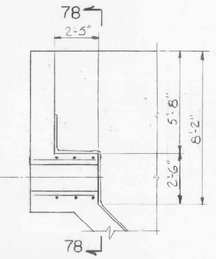
SECTION 75-75



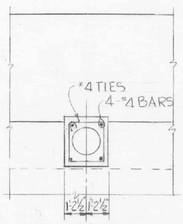
SECTION 76-76



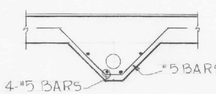
SECTION 70-70



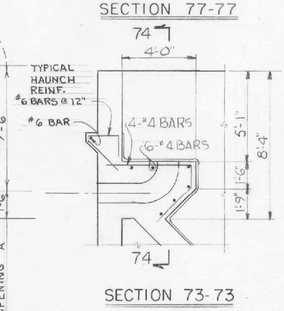
SECTION 77-77



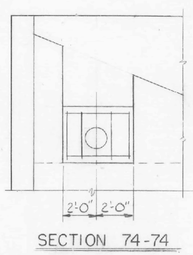
SECTION 78-78



SECTION 71-71



SECTION 73-73



SECTION 74-74

GENERAL NOTES:

ALL CONCRETE TO HAVE 3,000 P.S.I. COMPRESSIVE STRENGTH.

ALL REINFORING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A-305.

SEE MECHANICAL DRAWINGS FOR DETAILS NOT SHOWN ON STRUCTURAL PLANS.

MINIMUM LAP SHALL BE 30 BAR DIAMETERS.

12" CRUSHED STONE UNDER ENTIRE BOTTOM OF STRUCTURE.

REINFORCING IN SHOTCRETE IS 2"x2"-12/12 COLD DRAWN WELDED WIRE MESH.

Edward A. Kidd 2/1/68

STATE OF MARYLAND · EDWARD ALPHONSE KIDD · No. 3041 · REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE
1	REVISED CONC. & REINFORCMENT	[illegible]	JAN. 1968

CITY OF ROCKVILLE MARYLAND

DESIGNED	APPROVED 2/1/68 DATE	GRAD.	
TRACED		PAV.	
CHECKED		SD	
	DIRECTOR OF PUBLIC WORKS	W	
		S	
		OTHER	

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED	5/15/67
DATE PROJECT COMPLETED	
DATE ACCEPTED BY CITY	
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM	

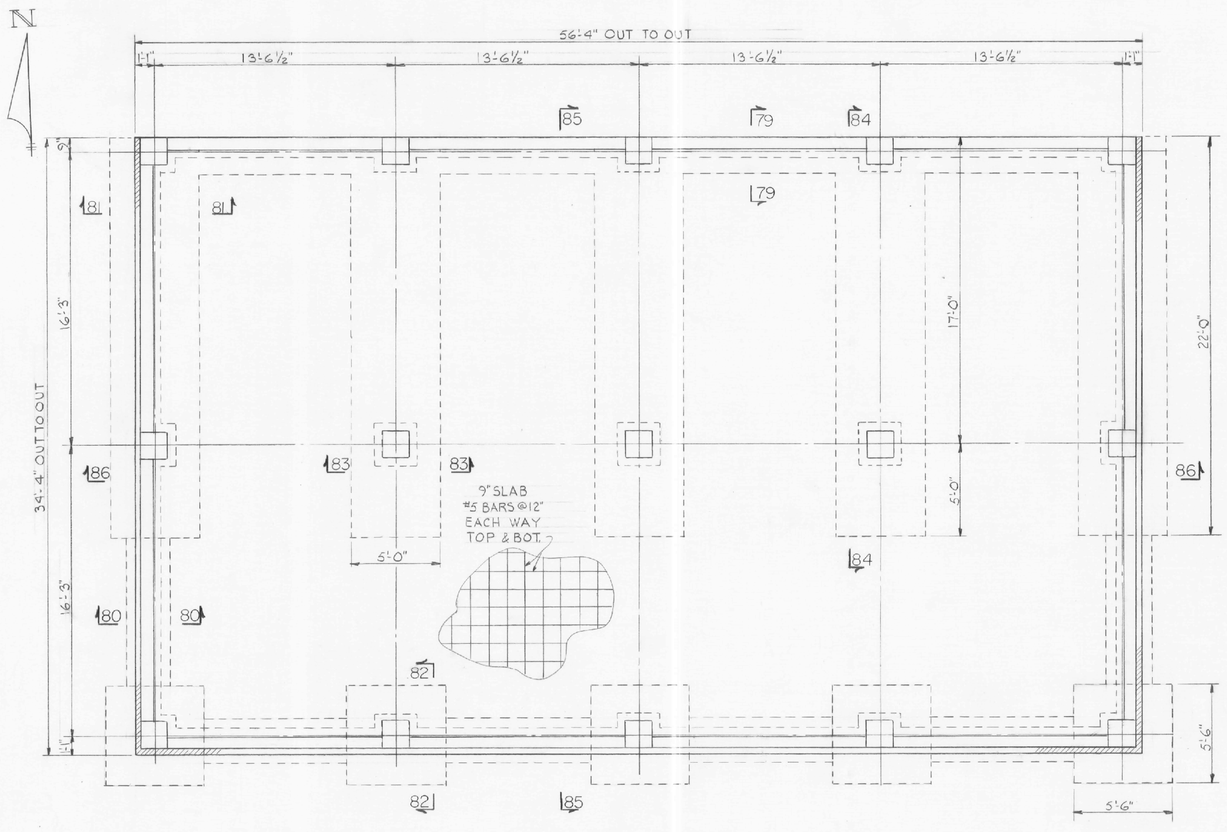
AS BUILT COMPLETED 5/11/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CLARIFIER
STRUCTURAL DETAILS

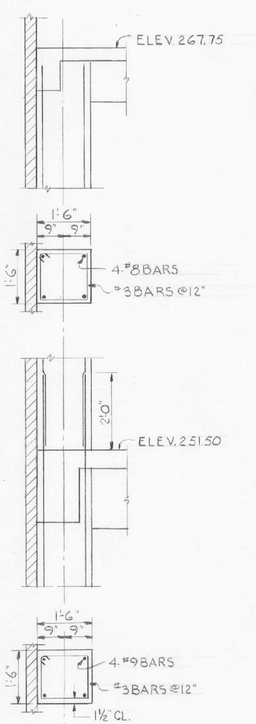
DATE	SCALE	DRAWING	FILE
DEC. 1965	1/4" = 1'-0"	NO. 32	WTP-16
JOB NO. 65-310-W		OF 36	

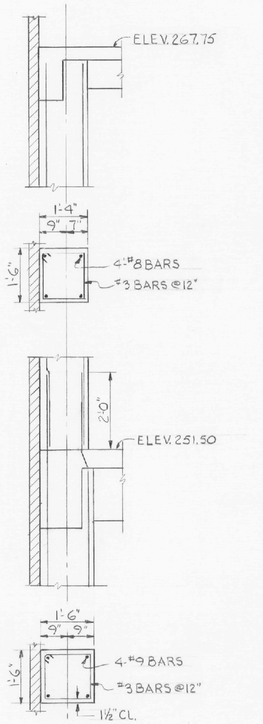
905 of 921

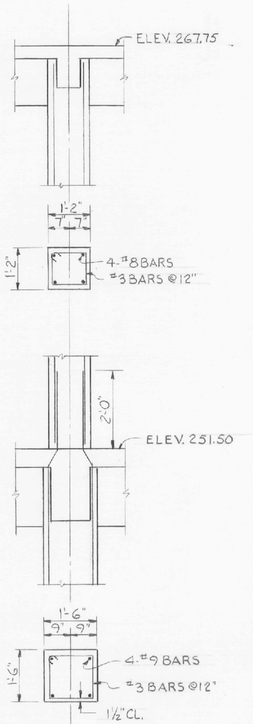


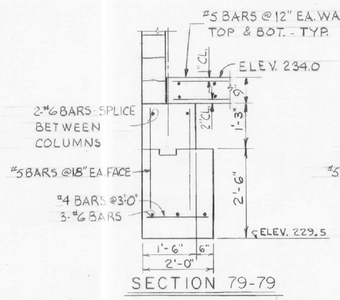
PLAN

SCALE: 1/4"=1'-0"

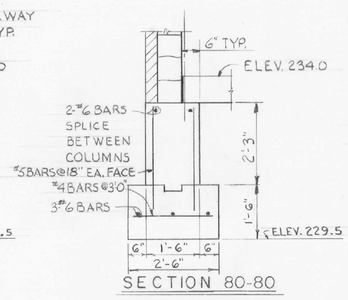




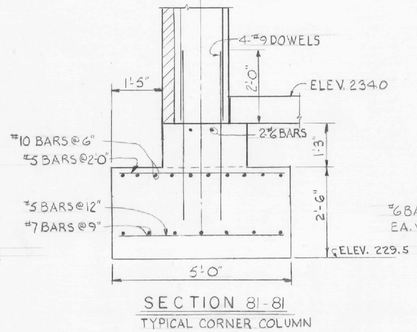




SECTION 79-79

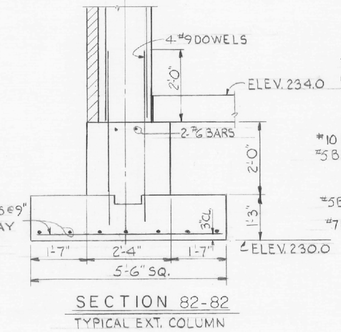


SECTION 80-80



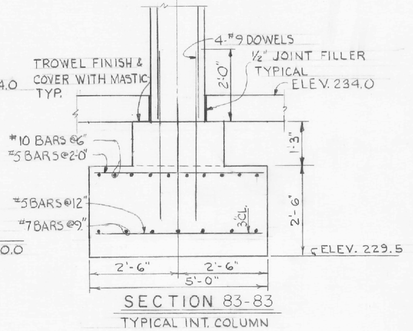
SECTION 81-81

TYPICAL CORNER COLUMN



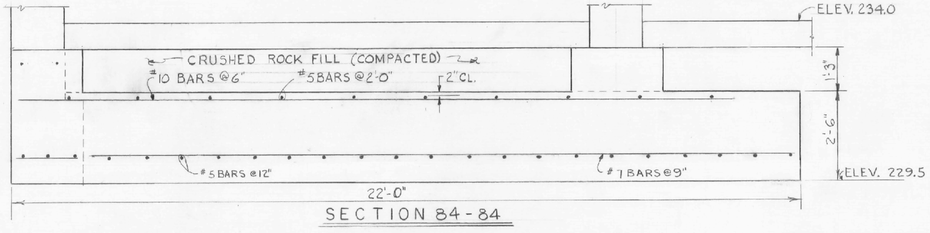
SECTION 82-82

TYPICAL EXT. COLUMN



SECTION 83-83

TYPICAL INT. COLUMN



SECTION 84-84

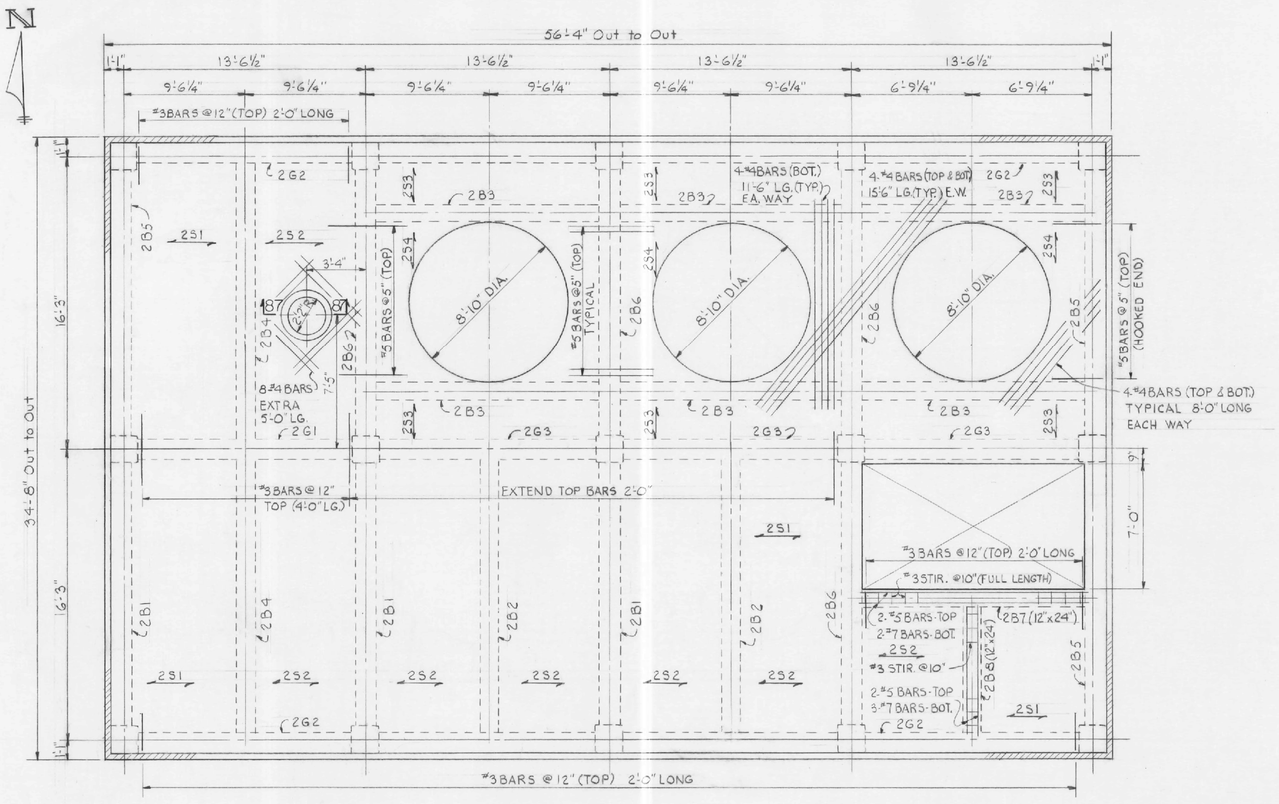
Edward A. Riddel 2/1/66

STATE OF MARYLAND
EDWARD ALPHONSO RIDDEL
No. 3841
REGISTERED
PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

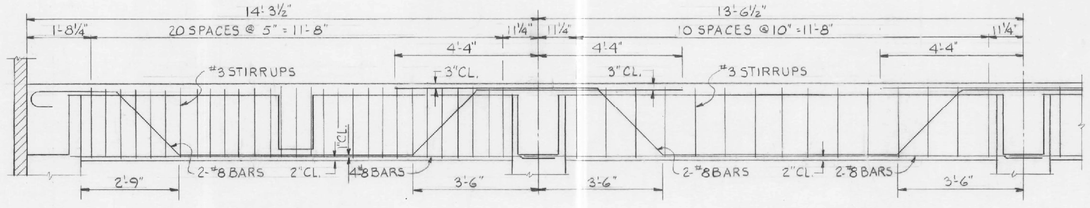
DESIGNED	APPROVED 2-1-66 DATE	GRAD.	DEPARTMENT OF PUBLIC WORKS	DATE PROJECT STARTED	AS BUILT COMPLETED 9/12/69 DATE	BAKER-WIBBERLEY & ASSOCIATES, INC.	ENLARGEMENT OF WATER TREATMENT PLANT	NO.	REVISIONS	APP'D	DATE
TRACED		PAV.	CITY OF	DATE PROJECT COMPLETED		CONSULTING ENGINEERS	**CHEMICAL BUILDING**				
CHECKED	DIRECTOR OF PUBLIC WORKS	SD	ROCKVILLE	DATE ACCEPTED BY CITY	CHIEF INSPECTOR	HAGERSTOWN, MARYLAND	STRUCTURAL DETAILS-1ST FL., FOUND. & COLUMNS	DATE DEC. 1965	SCALE 1/2"=1'-0" OR AS NOTED	DRAWING NO. 33	FILE WTP-16
		W	111 SOUTH PERRY STREET ROCKVILLE, MARYLAND	DATE TRANS. TO FINANCE DEPT., W/R & FORM				JOB NO. 65-310-W		OF 36	
		S									
		OTHER									

366 of 821

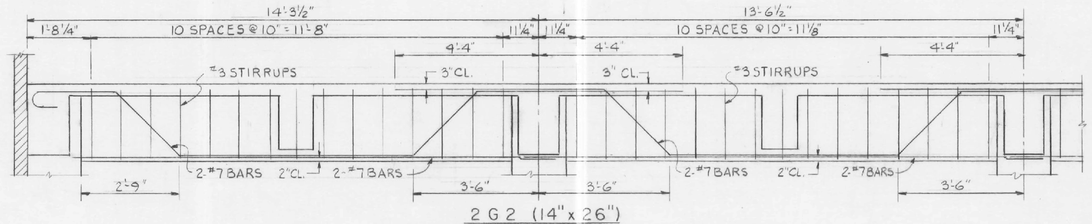


2nd FL. PLAN

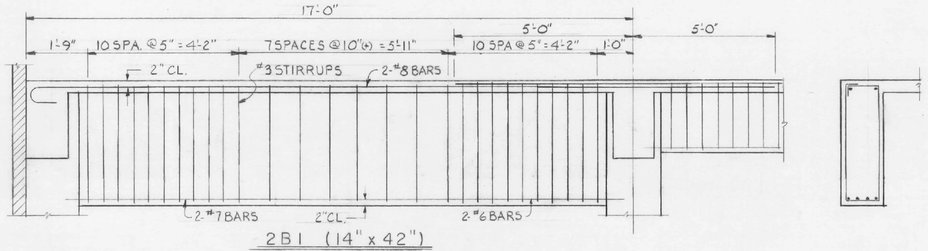
SCALE: 1/4"=1'-0"
(TOP OF FINISHED FLOOR ELEV. 251.50)



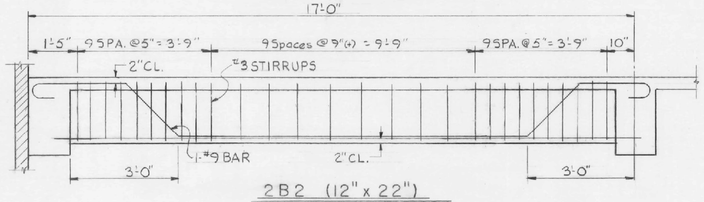
2G1 (14"x26") 2G3 (14"x26")



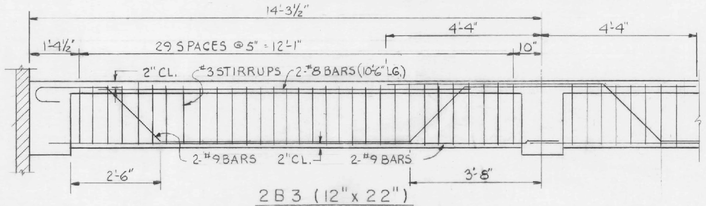
2G2 (14"x26")



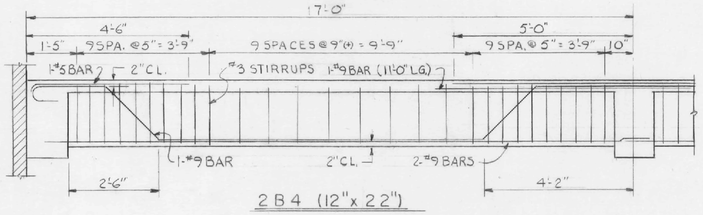
2B1 (14" x 42")



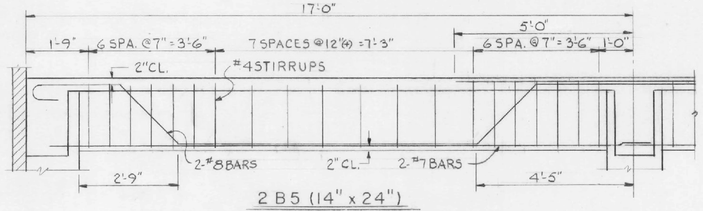
2B2 (12" x 22")



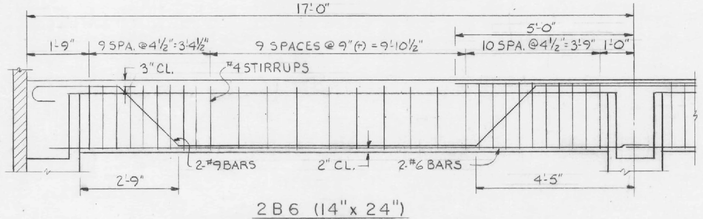
2B3 (12" x 22")



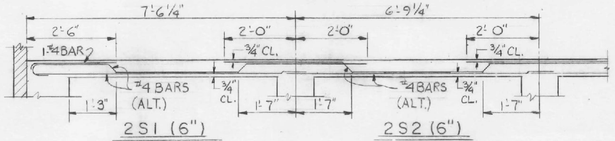
2B4 (12" x 22")



2B5 (14" x 24")



2B6 (14" x 24")



2S1 (6") 2S2 (6")

NOTES:
PROVIDE 2-#3 BARS FOR LENGTH OF STIRRUP SPACING. IN EDGE BEAMS USE CLOSED STIRRUPS AND PLACE 1-#4 BAR IN EACH CORNER.

SLAB SCHEDULE

Mark	Depth	Main Steel	Temp. Steel	Remarks
2S1	6"	#4 @ 10"	#4 @ 16"	ALTERNATE STRAIGHT & TRUSS
2S2	6"	#4 @ 10"	#4 @ 16"	ALTERNATE STRAIGHT & TRUSS
2S3	6"	#3 @ 10"	#3 @ 14"	STRAIGHT TOP & BOTTOM
2S4	6"	AS SHOWN		

Edward A. Reid 2/1/66
STATE OF MARYLAND — EDWARD ALPHONSO REID — No. 3841 — REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

DESIGNED
TRACED
CHECKED
APPROVED 2/16/66 DATE — DIRECTOR OF PUBLIC WORKS
GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R & FORM

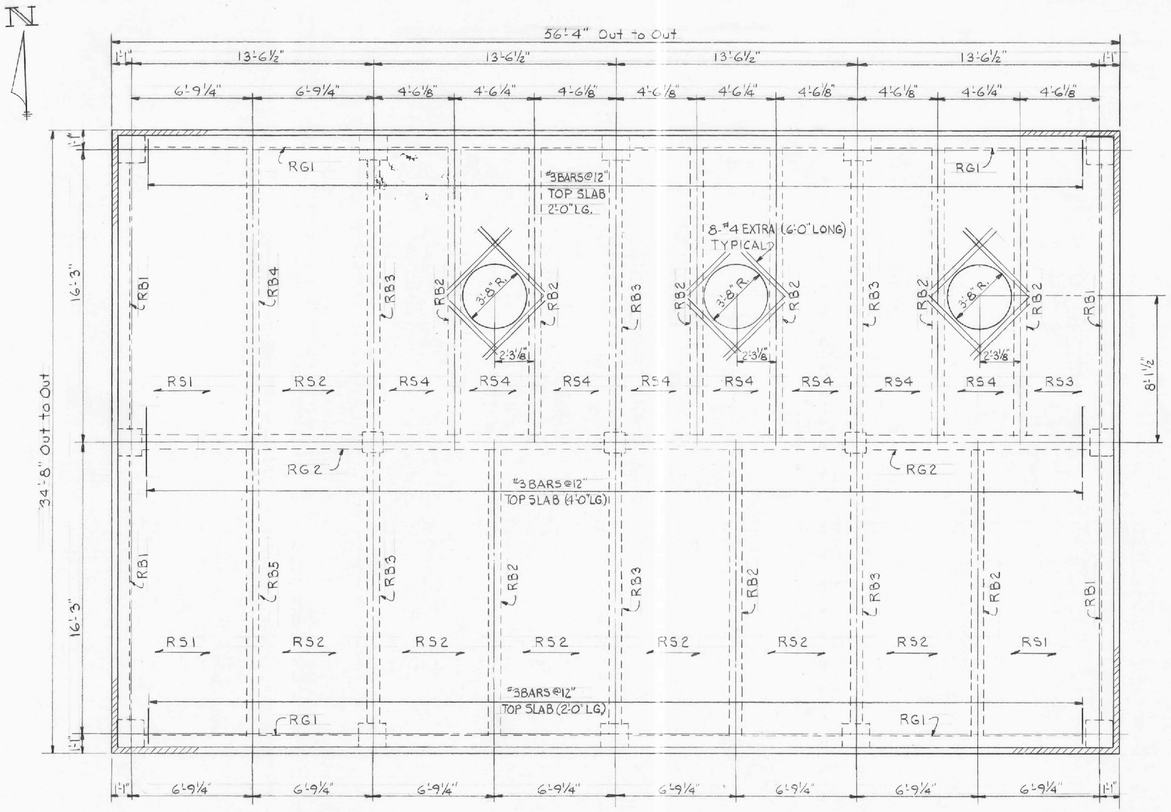
AS BUILT COMPLETED 9/12/69 DATE
William R. Moore CHIEF INSPECTOR

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

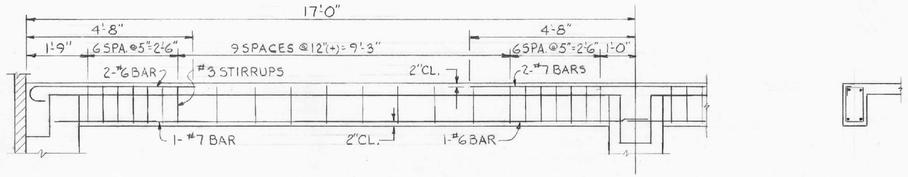
ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
STRUCTURAL DETAILS - SECOND FLOOR

NO.	REVISIONS	APP'D	DATE

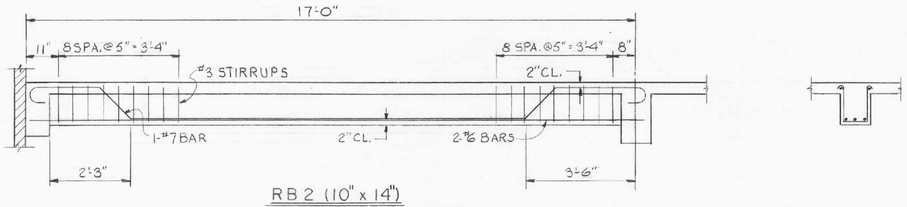
DATE: DEC. 1965
JOB NO. 65-310-W
SCALE 1/2"=1'-0" OR AS NOTED
DRAWING NO. 34 OF 36
FILE WTP-16



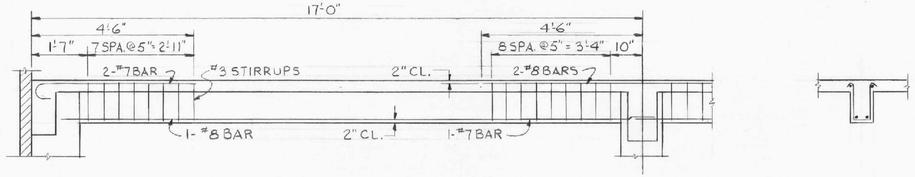
ROOF PLAN
SCALE: 1/4" = 1'-0"



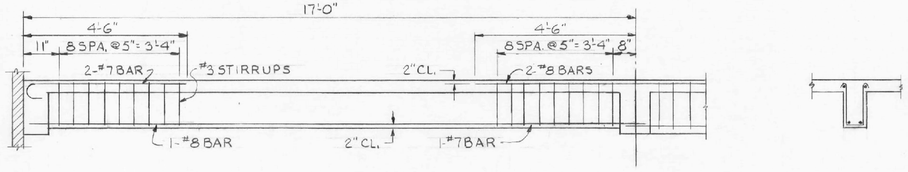
RB1 (8"x 14")



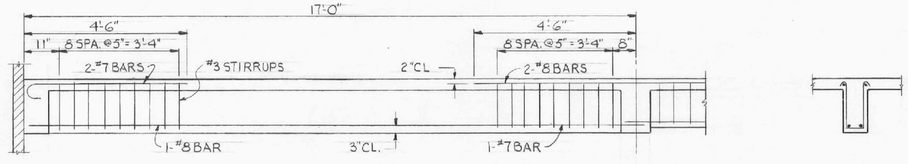
RB 2 (10" x 14")



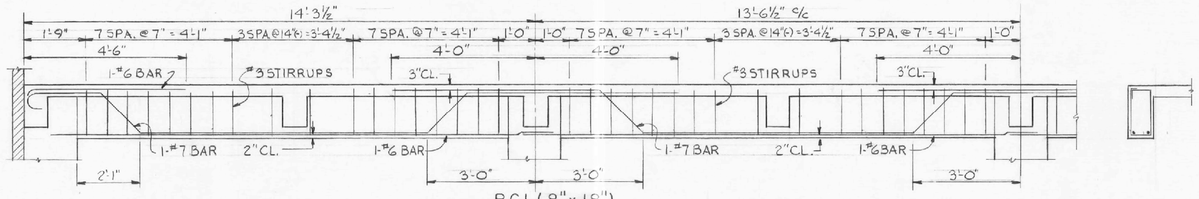
RB 3 (8"x 14")



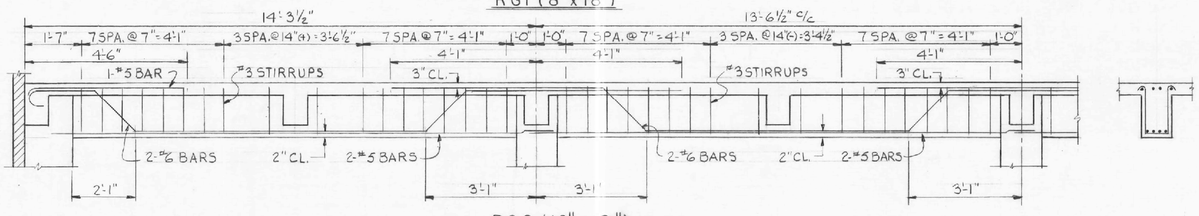
RB 4 (8"x 14")



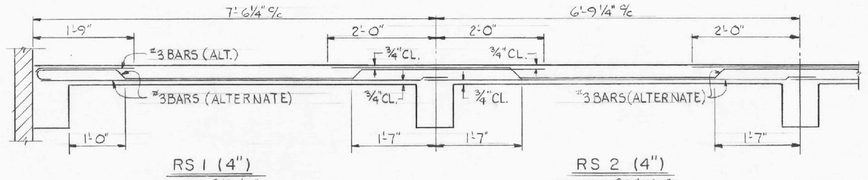
RB 5 (8"x 18")



RG1 (8"x 18")



RG2 (10"x 18")



RS 1 (4")
SCALE: ¾" = 1'-0"

RS 2 (4")
SCALE: ¾" = 1'-0"

NOTES:
PROVIDE 2-#3 BARS FOR LENGTH OF STIRRUP SPACING. IN EDGE BEAMS USE CLOSED STIRRUPS AND PLACE 1-#4 BAR IN EACH CORNER.

SLAB SCHEDULE

Mark	Depth	Main Steel	Temp. Steel	Remarks
RS1	4"	#3 @ 12"	#3 @ 14"	ALTERNATE STRAIGHT & TRUSS
RS2	4"	#3 @ 12"	#3 @ 14"	ALTERNATE STRAIGHT & TRUSS
RS3	4"	#3 @ 12"	#3 @ 14"	STRAIGHT TOP & BOTTOM
RS4	4"	#3 @ 12"	#3 @ 14"	STRAIGHT TOP & BOTTOM

Edward A. Kidd 3/1/66

STATE OF MARYLAND · EDWARD ALPHONSO KIDD · No. 3841 · REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

NO.	REVISIONS	APP'D	DATE

DESIGNED
TRACED
CHECKED

APPROVED 3/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

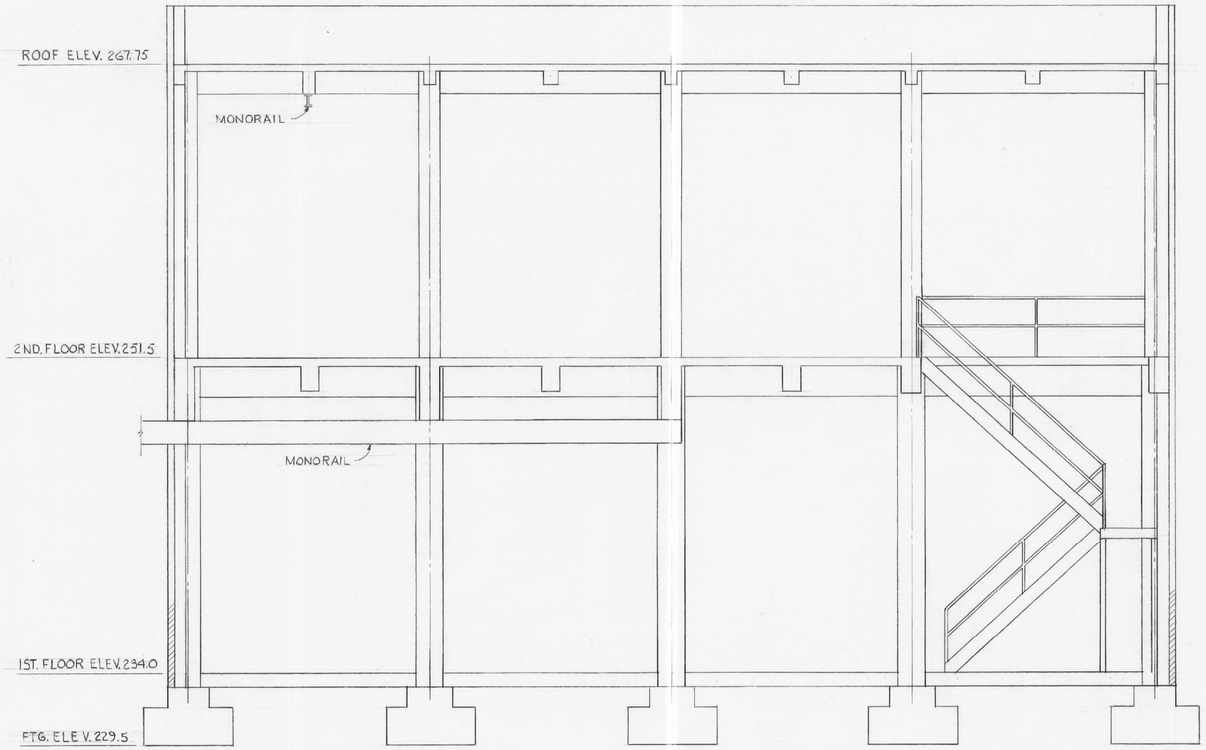
DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/12/69 DATE
William R. Moon CHIEF INSPECTOR

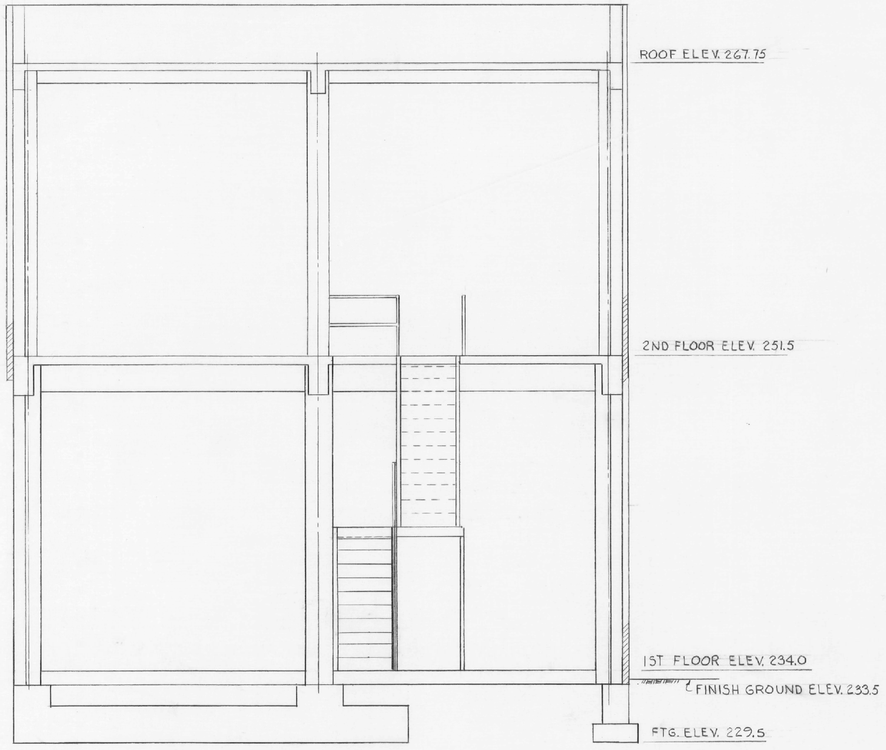
BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
STRUCTURAL DETAILS - ROOF

DATE: DEC. 1965
JOB NO. 65-310-W
SCALE: 1/2"=1'-0" OR AS NOTED
DRAWING NO. 35 OF 36
FILE WTP-16



SECTION 86-86



SECTION 85-85

GENERAL NOTES: (CHEMICAL BLDG.)

ALL CONCRETE TO HAVE 3,000 P.S.I. COMPRESSIVE STRENGTH. f_c = 1,350 P.S.I.

ALL REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A-305, AND SHALL BE DETAILED TO CONFORM TO A.C.I. CODE. f_s = 20,000 P.S.I.

A SOIL BEARING CAPACITY OF 3,000 P.S.F. WAS ASSUMED IN THE FOOTING DESIGN, IF SOIL OF THIS CAPACITY IS NOT ENCOUNTERED AT THE ELEVATIONS SHOWN, FOOTINGS SHALL BE LOWERED OR INCREASED IN SIZE AS DIRECTED BY THE ENGINEER.

SEE MECHANICAL DRAWINGS FOR DETAILS NOT SHOWN ON STRUCTURAL PLANS.

ALL LINTELS TO HAVE 8" MIN. END BEARING.

Edward A. Kidd 2/1/66

STATE OF MARYLAND — EDWARD ALPHONSUS KIDD — No. 3993 — REGISTERED PROFESSIONAL ENGINEER

HUD PROJECT NO. WS-2-21-0001

CITY OF ROCKVILLE MARYLAND

DESIGNED
TRACED
CHECKED

APPROVED 2/16/66 DATE
DIRECTOR OF PUBLIC WORKS

GRAD.
PAV.
SD
W
S
OTHER

DEPARTMENT OF PUBLIC WORKS
CITY OF
ROCKVILLE
111 SOUTH PERRY STREET ROCKVILLE, MARYLAND

DATE PROJECT STARTED 5/15/67
DATE PROJECT COMPLETED
DATE ACCEPTED BY CITY
DATE TRANS. TO FINANCE DEPT., W/R 9 FORM

AS BUILT COMPLETED 9/12/69 DATE
William R. Moore CHIEF INSPECTOR

300 of 321

BAKER-WIBBERLEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
HAGERSTOWN, MARYLAND

ENLARGEMENT OF WATER TREATMENT PLANT
CHEMICAL BUILDING
STRUCTURAL DETAILS - SECTIONS

NO.	REVISIONS	APP'D	DATE

DATE: DEC. 1965
JOB NO.: 65-310-W
SCALE: 1/4"=1'-0"
DRAWING NO. 36 OF 36
FILE: WTP-1

Rockville Water Treatment Plant
Chemical Building
Silo #3 (Concrete Pad, Feeder Chute, Hopper, and Bin) Pictures

Picture #1

First Floor – front view

- Bottom of Feeder Chute on Silo at Concrete Pad Elevation
- Concrete Pad, Equipment & Materials

Picture #2

First Floor – side view

- Bottom of Feeder Chute on Silo at Concrete Pad Elevation
- Concrete Pad, Equipment & Materials

Picture #3

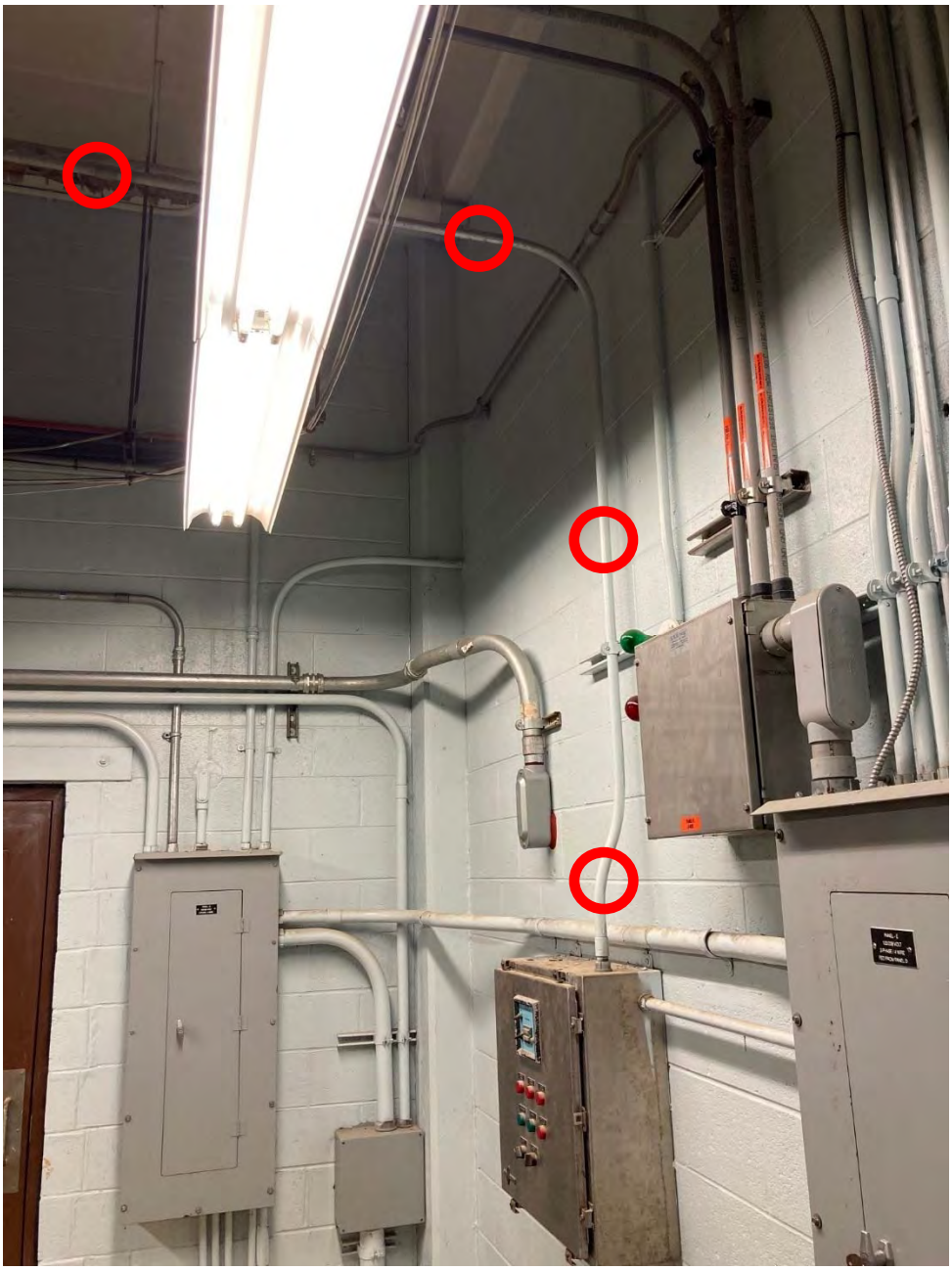
First Floor – side view

- Bottom of Feeder Chute on Silo at Concrete Pad Elevation
- Concrete Pad, Equipment & Materials
- Gray conduit #1 (2” Drain) heading toward Clarifier Gallery Tunnel
- Gray conduit #2 (2” Carbon Slurry) heading toward Clarifier Gallery Tunnel
- Water connection (3/4” non-potable water) running below gray conduits.

Picture #4

First Floor

- Behind Feeder on Silo at Concrete Pad Elevation
- Gray conduit #1 (2” Drain) heading toward Clarifier Gallery Tunnel
- Gray conduit #2 (2” Carbon Slurry) heading toward Clarifier Gallery Tunnel
- Water connection (3/4” non-potable water) running below gray conduits.



Picture #5

First Floor

- Wall facing front of Silo Feeder and Concrete Pad
- Electrical conduit running from Silo over the electrical panel

Picture #6

First Floor – front view

- Silo Feeder Chute
- Elevation above Concrete Pad and Equipment

Picture #7
First Floor – side view
Connection between Silo Hopper and Feeder Chute

Picture #8

First Floor – front view

- Looking up at the ceiling (second floor opening)
- Connection between Silo Hopper and Feeder Chute
- Silo Bin is located on the 2nd floor

Picture #9

Second Floor – side view

Silo #3

- Silo Bin between Rooftop and 2nd floor
- Silo Hopper and Feeder Chute are not in view, located below on 1st floor
- Former dust collection mechanism (tube) is shown attached to the top of the Silo

Picture #10

Second Floor – front view

Silo #3

- Showing one of two level indicator devices mounted on side of the Silo Bin
- Looking up at the 2nd floor ceiling, showing the penetration of former dust collector mechanism, only the tube remains.
- Roof penetration has been sealed. See pictures #11 and #12

Picture #11

Roof top – looking east

All three Silo dust collector mechanisms are removed and penetrations have been sealed.

Referencing the picture above, starting from the closest penetration and working away.

- Silo #1 – blind flange sealing the opening
- Silo #2 – sealed cover over the opening
- Silo #3 – blind flange sealing the opening

Picture #12

Roof top – looking north

Silo #3 – former location of dust collection mechanism

- Blind flange sealing the opening
- Penetration sealed and flange installed as part of the Ferric Chloride Feed System project around 2017