Forrest City
New City Hall
Forrest City, Arkansas
Volume 1

Prepared for:

CITY OF FORREST CITY
FORREST CITY, ARKANSAS

December, 2016

ETC ENGINEERS & ARCHITECTS, INC.
1510 SOUTH BROADWAY
LITTLE ROCK, AR 72202

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Forrest City
New City Hall
Forrest City, Arkansas

ETC Project Number 163902CFC

ADVERTISEMENT FOR BIDS

The City of Forrest City, Arkansas will receive sealed bids at City Hall, 224 North Rosser Street, Forrest City, Arkansas 72335 for the Construction of **"Forrest City New City Hall"**, in St. Francis County, **until 2:00 p.m. on December 6, 2016** at which time and place all bids will be publicly opened and read aloud.

The Information for Bidders, Form of Bid, Form of Contract, Plans, Specifications, and Forms of Bid Bond, Performance and Payment Bond and other contract documents may be examined at the following locations:

ETC Engineers & Architects, Inc. 1510 South Broadway Little Rock, AR 72202	Southern Reprographics, Inc. Plan Room Services 901 West 7th Street Little Rock, AR 72201
City of Forrest City City Hall 224 North Rosser Street Forrest City, AR 72335	

To submit a bid, Contract Documents must be purchased from ETC Engineers & Architects, Inc., 1510 South Broadway, Little Rock, AR 72202, (501) 375-1786, at a cost of One Hundred Fifty Dollars ($150.00), non-refundable.

A certified check or bank draft, payable to the order of the City of Forrest City, negotiable U.S. Government bonds (at par value), or satisfactory bid bond executed by the bidder and an acceptable surety in an amount equal to five (5%) of the total bid shall be submitted with each bid.

The City hereby notifies all bidders that this contract is subject to applicable labor laws, non-discrimination provisions, wage rate laws and other federal laws including the Fair Labor Standards Acts of 1938. The Work Hours Act of 1962 and Title VI of the Civil Rights Act of 1964 also apply.

Attention is called to the fact that not less than the minimum salaries and wages as set forth in the contract documents must be paid on the project, and that the contractor must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex or national origin.

The City reserves the right to reject any or all bids or to waive any informality in bidding. Bids may be held by the City for a period not to exceed Sixty (60) days from the date of opening of bids for the purpose of reviewing the bids and investigating the qualifications of bidders prior to awarding the contract.

City of Forrest City
Mayor Larry Bryant

SECTION 00004 - INFORMATION FOR BIDDERS

1. PROJECT SITE

The construction of the Forrest City New City Hall to be accomplished by the contract is located in the City of Forrest City, St. Francis County, Arkansas.

Work consists of the following: **Construction of a New City Hall for Forrest City, Arkansas. The building consists of a wood framed and structural steel structure with brick veneer and metal siding exterior finishes. Roofing includes metal and membrane roofing systems. Interior partitions are wood framed with gypsum board. Interior finishes include stained concrete, carpet, paint, ACT, and wood decking.**

2. MANDATORY PRE-BID CONFERENCE

There will not be a mandatory pre-bid conference.

3. RECEIPT AND OPENING OF BIDS

The City of Forrest City (OWNER) invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the City of Forrest City at City Hall, 224 North Rosser Street, Forrest City, AR 72335, at the time shown on the "Advertisement for Bid", and then at said place publicly opened and read aloud. The envelopes containing the bids will be prepared as indicated below.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 60 days after the actual date of the opening thereof.

4. PREPARATION OF BID

These contract documents include a complete set of bidding and contract forms which are for the convenience of bidders and are not to be detached from the contract documents, filled out or executed.

Each bid must be submitted on the prescribed bid form as well as accompanied by a Bid Bond. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures, and the foregoing certifications must be fully completed and executed when submitted.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his address, and the name of the project for which the bid is submitted. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form.

At the time of bid opening, the envelope containing the bid and bid bond will be opened and read aloud for the purpose of qualifying the bid. After all bids and required contract documents have been thoroughly checked by the owner, the successful bidder will be announced and personally informed. Should a low bidder fail to execute all required documentation qualifying his bid, the bid may be rejected and the next lowest bidder awarded the work if he has qualified.

Envelope will be clearly marked as follows:

FROM:_____
(Name of Concern)

ADDRESS:_____
(Street or P.O. Box)
(City, State, Zip Code)

TO: City of Forrest City
Mayor Larry Bryant

Construction of: **Forrest City New City Hall**

To Be Opened: _____

5. SUBCONTRACTS

The bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract, this contractor must possess a current Arkansas Contractors License and must be able to obtain bonding, and must be acceptable to the owner.

6. FACSIMILE MODIFICATION

Any bidder may modify his bid by facsimile at any time prior to the scheduled opening time for receipt of bids, provided such facsimile is received by the owner prior to the opening time, and, provided further, the owner is satisfied that a written confirmation of the facsimile modification with the signature of the bidder was mailed prior to the bid opening time. The facsimile should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known by the owner until the sealed bid is opened. If written confirmation is not received within **two (2) days** from the bid opening time, no consideration will be given to the facsimile modification.

7. METHOD OF BIDDING

Method of bidding for the project will be as follows:

The proposal is defined as a "Lump Sum Contract". All bids are lump sum and to include all cost associated with the project for a complete turnkey construction.

Bidders must satisfy themselves of the accuracy of the estimated quantities in the bid schedule by examination of the site and a review of the drawings and specifications including Addenda. After bids have been submitted, the bidder shall not assert that there was a misunderstanding concerning the quantities of work or the nature of the work to be done. No alternate bids will be considered unless alternate bids are specifically required by the contract documents.

8. QUALIFICATIONS OF BIDDER

The Owner may make such investigations as he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish the Owner all such information and data for this purpose as the owner may request. The owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids shall not be accepted.

9. BID SECURITY

Each bid must be accompanied by a certified check of the bidder, or a bid bond prepared on the form of bid bond attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the owner, in the amount of 5% of the bid. Such check or bid bond will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining check or bid bond will be returned promptly after the owner and the accepted bidder have executed the contract, or, if no award has been made within 60 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of this bid.

10. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful bidder, upon his failure or refusal to execute and deliver the contract and bonds required within **ten (10)** days after he has received notice of the acceptance of this bid, shall forfeit to the owner, as liquidated damages for such failure or refusal, the security deposited with his bid.

11. TIME OF COMPLETION

Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" and to fully complete the project within **Two Hundred Seventy (270)** consecutive calendar days thereafter.

12. LIQUIDATED DAMAGES FOR DELAY IN COMPLETION

As actual damages for any delay in completion of the work which the Contractor will be required to perform under the Contract are impossible to determine, the Contractor and his Sureties will be liable for and shall pay to the Owner the sum of **$150.00** as fixed, agreed and liquidated damages for each calendar day of delay from the date stipulated pursuant to the preceding paragraph.

13. CONDITIONS OF WORK

Each bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provision of his contract. Insofar as possible, the contractor in carrying out his work must employ such methods or means as will not cause any interruption of or interference with the work or any other contractor.

14. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to ETC Engineers & Architects, Inc. at 1510 South Broadway, Little Rock, Arkansas, 72202 RE: **Forrest City New City Hall**. To be given consideration, the request must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instruction will be in the form of written addenda to the contract documents which, if issued, will be mailed by certified mail with return receipt requested or sent by facsimile to all prospective bidders (at the respective addresses or fax numbers furnished for such purposes), not later than three days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

15. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bonds shall be a duly authorized company satisfactory to the owner. The use of Arkansas Performance and Payment Bond (14-604 Arkansas Statutes, Rev. 1/76) is mandatory.

16. POWER OF ATTORNEY

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

17. NOTICE OF SPECIAL CONDITIONS

Attention is particularly called to those parts of the contract documents and specifications which deal with the following:

1. Construction Schedule and Periodic Estimates
2. Payments to Contractor
3. Equal Employment Opportunity
4. Certification of Compliance with Air and Water Acts
5. Work by Others
6. Layout of Work
7. Construction Sequence, Maintenance of Traffic, and Maintenance of Access to Individual Properties
8. Contract to Check Plans and Schedules
9. Maintenance Bonds
10. Testing Laboratory Services

18. LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

19. METHOD OF AWARD - LOWEST QUALIFIED BIDDER

If at the time this contract is to be awarded, the lowest base bid submitted by a responsible bidder does not exceed the amount of funds available to finance the contract, the contract will be awarded on the base bid only. If such bid exceeds such amount, the owner may reject all bids or accept one or more deductive bid alternates.

20. OBLIGATION OF BIDDER

At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of this bid.

21. SAFETY STANDARDS AND ACCIDENT PREVENTION

With respect to all work performed under this contract, the contractor shall:

a. Comply with the safety standards provisions of applicable laws, building and construction codes and the Manual of Accident Prevention in Construction:

published by the Associated General Contractors of America, the requirements of the Occupation Safety and Health Act of 1970 (Public Law 91-596 and the requirement of Title 29 of the Code of Federal Regulations, Section 1518 as published in the Federal Register, Volume 36 No. 75, Saturday, April 17, 1971).

b. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.

c. Maintain at his office or other well-known place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site.

22. ARKANSAS STATE LICENSING LAW

a. Attention of bidders is particularly called to the requirements that all bidders must be in compliance with the requirements of Act 150 of 1965 of the State of Arkansas, effective June 3, 1965, which is the current Arkansas State Licensing * Law for Contractors.

b. Each bidder submitting a bid to the owner for any portion of the work contemplated by the documents of which bidding is based shall execute and include in the submission of the bid, a certification substantially in the form herein provided to the effect that he has a current Arkansas State Contractor's License* in compliance with the requirements of the aforementioned law.

END OF SECTION

BID PROPOSAL

Bid Time:
Bid Date:
Location: City of Forrest City
City Hall
224 North Rosser Street
Forrest City, AR 72335

FROM: _____

BID TO: **City of Forrest City**

PROJECT: **'Forrest City New City Hall'**

Gentlemen:

1. The undersigned bidder, in compliance with your request for bids for the above referenced project, having examined specifications, related documents, and site of the proposed project, hereby proposes to construct the Sherwood Farmers Market Pavilion as described in the specifications contained in this solicitation for bids. These prices entered under "Total Bid" are for a complete turnkey project inclusive of all labor and materials and are to cover the specified equipment and delivery charges as stipulated in the scope of work. Having carefully examined the Contract Documents for this project, as well as the premises and all conditions affecting the proposed construction, the undersigned proposes to provide all labor, materials, services, and equipment necessary for, or incidental to, the construction of the project in accordance with the Contract Documents including the general conditions within the time set forth, for the lump sum base Total Bid of:

   $_____
   Dollar Amount Is To Be Shown Numerically

   _____
   Dollar Amount Is To Be Shown Alphabetically

2. Ark. Code Ann.ß 22-9-212 requires the contractor to indicate on this bid form the cost of Trenching Safety Systems. FAILURE TO SHOW THIS COST WILL INVALIDATE THE BID. (NOTE THIS COST SHALL BE INCLUDED IN THE ABOVE BASE BID)

   _____
   Dollar Amount Is To Be Shown Numerically

3. Completion Date: Bidder agrees that the work will be complete and ready for final payment in accordance with the Contract Documents within **Two Hundred Seventy (270)** consecutive calendar days.

4. The undersigned, in compliance with the Contract Documents for the construction of the above named project, does hereby declare:

   a. That the undersigned understands that the Owner reserves the right to reject any and all bids and to waive any formality.

   b. The contract will be awarded to the lowest responsive bidder, which is within Owner's budget constraint.

   c. That if awarded the Contract, the undersigned will enter into an Agreement, on a form identical to the form included in the Contract Documents and execute required performance and payment bonds within Seven (7) days after receipt of the Intent to Award, will commence work within Five (5) days after the date of the Notice to Proceed, and will complete the Contract fully within **Two Hundred Seventy (270)** consecutive calendar days for thereafter. Should the undersigned fail to fully complete the work within the above stated time, he shall pay the Owner as fixed, agreed and liquidated damages and not as a penalty, the sum of **One Hundred Fifty Dollars ($150)** for each calendar day of delay until the work is completed or accepted.

   d. The undersigned further agrees that the bid security payable to Owner and accompanying this proposal shall become the property of the Owner as liquidated damages if the undersigned fails to execute the Contract or to deliver the required bonds to the Owner within Seven days from receipt of the Intent to Award as these acts constitute a breach of the Contractor's duties.

   e. That this bid may not be withdrawn for a period of 60 days after the bid opening.

   f. The undersigned understands that the Owner's intent is to construct all facilities proposed within the limits established by the funds appropriated for the project.

   g. The names of subcontractors and the nature of the work to be performed by each one have been included on the Bid Form.

   h. The undersigned agrees to pay all prevailing hourly wage rates prescribed and mandated by Ark. Code Ann. ß 22-9-301 et. seq., if the bid exceeds $75,000) or the undersigned agrees to pay all prevailing hourly wage rates mandated by the Davis-Bacon Wage Rates and any other applicable federal regulations.

   i. Bids submitted by a Joint Venture/Joint Adventure shall be signed by representatives of each component part of the Joint Venture. The licenses of each component part of the Joint Venture shall also be listed in the bid submittal. Therefore, joint venture bidders shall indicate at least two (2) signatures and two (2) licenses numbers on the Bid Form. Exception: Joint Ventures who have been properly licensed with the Arkansas

Contractors Licensing Board as a Joint Venture need only to indicate the joint venture license number on the Bid Form. Joint Venture Bidders shall indicate at least two (2) signatures on the bid form even if they are licensed as a joint venture.

5. The following documents are attached to and made a condition of this Bid.

a. Bid security.

6. The undersigned acknowledges receipt of and inclusion as a part of the Contract.

7. Documents the following addenda:

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

8. LISTING OF ALL SUBCONTRACTORS INCLUDING MECHANICAL, PLUMBING, ELECTRICAL AND ROOFING SUBCONTRACTORS

All subcontractors including mechanical, plumbing, electrical and roofing subcontractors shall be listed regardless of qualifications, licenses or work amount.

Indicate the Name(s) and Address, of each entity performing the listed work:

MECHANICAL (Indicative of HVACR):

_____ License No: _____
Is the amount of work $20,000.00 or over: Yes___ No ___

ELECTRICAL & LIGHTING SUBCONTRACTOR:

_____License No: _____
Is the amount of work $20,000.00 or over: Yes___ No ___

PLUMBING:

_____ License No: _____
Is the amount of work $20,000.00 or over: Yes___ No ___

ROOFING AND SHEET METAL (Indicative of roofing applications):

_____ License No: _____
Is the amount of work $20,000.00 or over: Yes___ No ___

Respectfully Submitted:

_____
Name of Bidder (Typed or Printed)

_____

_____
Address

_____

BY: (Signature and Title)

_____
Contractor's License Number or Contractor's (Joint Venture) License Number(s)

_____
Telephone Number Fax Number

_____
Federal ID Number or SSN#

_____
Date of Bid

Forrest City
New City Hall
Forrest City, Arkansas

ETC Project Number 163902CFC

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____ _____ as Principal, and _____ _____ as Surety, are hereby held and firmly bound unto, City of Forrest City, Arkansas, as OWNER in the penal sum of five percent (5%) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns. Signed this_____day of _____, 2016.

The condition of the above obligation is such that whereas the Principal has submitted to the City of Forrest City a certain BID, attached hereto and hereby made a part hereof to enter into a contract in writing, for the Construction of the Forrest City New City Hall.

NOW THEREFORE

(a) If said BID shall be rejected, or in the alternate.

(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (properly completed in accordance with said BID) and shall furnish a BOND for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of the said BID.

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of the obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IMPORTANT Surety companies executing bonds must appear on the Treasurer Department's most current list (Circular 570, as amended) and be authorized in accordance with Section 22 of the General Conditions to transact business in the State of Arkansas.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____
Principal

_____
Surety

By: _____

Seal

Forrest City
New City Hall
Forrest City, Arkansas

ETC Project Number 163902CFC

AGREEMENT

THIS AGREEMENT made this _____ day of _____, 2016, by and between _____(a corporation organized and existing under the laws of the State of Arkansas) hereinafter called the "Contractor" and **City of Forrest City, 224 North Rosser Street, Forrest City, AR 72335** hereinafter called the "Owner".

WITNESSETH:

That the Contractor and the Owner for the consideration stated herein mutually agrees as follows:

ARTICLE 1. Statement of Work. The Contractor shall furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment, incidentals and services, including utility and transportation services and perform and complete all work described in Bid Form and as required for the construction of the **Forrest City New City Hall, Forrest City, St. Francis County, Arkansas,** in strict accordance with the Contract Documents prepared by ETC Engineers & Architects.

ARTICLE 2. The Contract Price: The stipulated contract price is_____ _____. The Owner will pay the contractor, because of his performance of the Contract, for the total quantities of work performed at the lump sum and unit prices stipulated in the Proposal, subject to additions, and deductions as provided in the Section entitled "CHANGES IN THE WORK" under GENERAL CONDITIONS.

ARTICLE 3. Contract Time. The Contractor agrees to begin work within ten (10) calendar days after issuance by the Owner of a "Work Order" or "Notice to Proceed" and to complete the work within **Two Hundred Seventy (270)** calendar days thereafter (except as modified in GENERAL CONDITIONS of these Contract Documents). If the Contractor shall fail to complete the work within the time specified, he and his Surety shall be liable for payment to the Owner, as liquidated damages ascertained and agreed, and not in the nature of a penalty, the sum of **One Hundred Fifty ($150) dollars** for each day of delay. To the extent sufficient in amount, liquidated damages shall be deducted from the payments to be made under this Contract.

ARTICLE 4. Contract. The executed Contract Documents shall consist of the following:

a. This Agreement
b. Addenda
c. Advertisement for Bids
d. Information for Bidders
e. Bid
f. General Conditions

g. Supplemental General Conditions
h. Technical Specifications

This Agreement, together with other Documents enumerated in this Article 4, which said other Documents are as fully a part of the Contract as if hereto attached to herein repeated, form the Contract between the parties hereto. In the event that any provisions in any component part of this Contract conflicts with any provision of any other component part, the conflict shall be resolved by the Engineer whose decision shall be final.

ARTICLE 5. Surety. The Surety on the Performance-Payment Bond shall be a surety company of financial resources satisfactory to the Owner and authorized to do business in the State of Arkansas.

IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed in six (6) counterparts, each of which shall be considered an original on the day and year first above written.

ATTEST:

_____

_____

CONTRACTOR

_____
(Contractor)

By:_____

Title_____

_____

City of Forrest City, Arkansas
(Owner)

By:_____

Title: _____

Forrest City
New City Hall
Forrest City, Arkansas

ETC Project Number 163902CFC

NOTICE TO PROCEED

To:

Date:

Project: **Forrest City New City Hall**

You are hereby notified to commence WORK in accordance with the Agreement dated _____
on or after _____, and you are to complete the work within _____consecutive calendar days thereafter. All required documentations such as Agreement, Performance Bond and Insurance should be submitted to the Architect/Engineer before or at the Pre-Construction conference meeting.

The date of completion of all WORK is therefore _____.

ETC Engineers & Architects, Inc.:

By:

Title: Project Manager

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____This the _____day of _____, 2016.

Contractor:

By:

Title:

Forrest City
New City Hall
Forrest City, Arkansas

ETC Project Number 163902CFC

Arkansas Statutory Payment and Performance Bond

We _____, as Principal, hereinafter called Principal, and _____ authorized to do business in the State of Arkansas, as Surety, hereinafter called Surety, are held and firmly bound unto _____ _____ as Obligee, hereinafter called Owner, in the amount of _____ _____ Dollars ($ _____), for the payment whereof Principal and Surety bind themselves, their heirs, personal representatives, successors and assigns, jointly and severally, by these presents.

Principal has by written agreement dated _____ entered into a contract with Owner for

_____

which contract is by reference made a part hereof and hereinafter referred to as the Contract.

THE CONDITION OF THIS OBLIGATION is such that if the Principal shall faithfully perform the Contract on his part and shall fully indemnify and save harmless the Owner from all cost and damage which he may suffer by reason of failure to do so and shall fully reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any such default, and further, that if the Principal shall pay all persons all indebtedness for labor or materials furnished or performed under said Contract, failing which such persons shall have a direct right of action against the Principal and Surety, jointly and severally, under this obligation, subject to the Owner's priority, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

No suit, action or proceeding shall be brought on this bond outside the State of Arkansas. No suit, action or proceeding shall be brought on this bond except by the Owner after six months from the date final payment is made on the Contract, nor shall any suit, action or proceeding be brought by the Owner after two years from the date on which the final payment under the Contract falls due.

Any alterations which may be made in the terms of the Contract, or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the Contract, or any other forbearance on the part of either the Owner or the Principal to the other shall not in any way release the Principal and the Surety or Sureties, or either or any of them, their heirs, personal representatives, successors or assigns from their liability hereunder, notice to the Surety or Sureties of any such alteration, extension or forbearance being hereby waived.

In no event shall the aggregate liability of the Surety exceed the sum set out herein.

Executed on this _____ day of _____, 20___

_____

Principal

_____

Surety Agent

_____

Attorney-in-Fact

ASA HUTCHINSON
GOVERNOR

STATE OF ARKANSAS
ARKANSAS DEPARTMENT OF LABOR
PREVAILING WAGE DIVISION

LEON JONES, JR.
DIRECTOR

10421 WEST MARKHAM • LITTLE ROCK, AR 72205-2190
Phone: 501-682-4536 Fax: 501-682-4506 TRS: 800-285-1131

November 10, 2016

Gerald Avery
ETC Engineers Inc
1510 S Broadway
Little Rock, AR 72202

Re: FORREST CITY NEW CITY HALL
FORREST CITY, ARKANSAS
ST FRANCIS COUNTY

Dear Mr. Avery:

In response to your request, enclosed is Arkansas Prevailing Wage Determination Number **16-261** establishing the minimum wage rates to be paid on the above-referenced project. These rates were established pursuant to the Arkansas Prevailing Wage Law, Ark. Code Ann. §§ 22-9-301 to 22-9-315 and the administrative regulations promulgated thereunder.

If the work is subject to the Arkansas Prevailing Wage Law, every specification shall include minimum prevailing wage rates for each craft or type of worker as determined by the Arkansas Department of Labor Ark. Code Ann. § 22-9-308 (b) (2). Also, the public body awarding the contract shall cause to be inserted in the contract a stipulation to the effect that not less than the prevailing hourly rate of wages shall be paid to all workers performing work under the contract. Ark. Code Ann. § 22-9-308 (c).

Additionally, the scale of wages shall be posted by the contractor in a prominent and easily accessible place at the work site. Ark. Code Ann. § 22-9-309 (a).

Also enclosed is a "**Statement of Intent to Pay Prevailing Wages**" form that should be put in your specifications along with the wage determination. The General/Prime Contractor is responsible for getting this form filled out and returned to this office within 30 days of the Notice to Proceed for this project.

When you issue the Notice to Proceed for this project, please send a copy of the notice to my office.

If you have any questions, please call me at (501) 682-4536 or fax (501) 682-4506.

Sincerely,

Lorna Kay Smith

Lorna K. Smith
Prevailing Wage Division

Enclosures

Arkansas Department of Labor Prevailing Wage Determination

Date: 11/10/2016 **Determination #:** 16-261 **Expires:** 5/10/2017

Project: Forrest City New City Hall

Site:

City: Forrest City, Arkansas

Project County: **St Francis** **Survey#:** 716-AR07

COUNTY(S)	Group
Crittenden	7
Cross	
Lee	
Phillips	
St Francis	

CLASSIFICATION	Basic Hourly Rate	Fringe Benefits
Asbestos Worker/Insulator	$15.80	$2.85
Boilermaker	$18.48	$5.71
Bricklayer/Pointer, Cleaner, Caulker, Stone Mason	$18.65	
Carpenter	$16.20	$3.65
Concrete Finisher/Cement Mason	$14.25	$3.25
Electrician/Alarm Installer	$19.70	$4.15
Glazier	$16.00	$1.60
HVACR Mechanic (Excludes Duct Work)	$16.00	
Ironworker (Including Reinforcing Work)	$19.00	$7.93
Laborer	$12.40	
Metal Building Erector	$12.40	
Millwright	$15.10	$3.48
Painter/Sheet Rock Finisher	$14.20	
Plumber/Pipefitter	$18.25	$2.00
Roofer	$10.80	$2.20
Sheet Metal (Includes Duct Work)	$19.00	
Sprinkler Fitter	$21.75	$10.85
Group 1 - Operator	$15.20	$2.65
Group 2 - Operator	$18.00	
Group 4 - Operator	$15.00	
Truck Driver (Excludes Dump Truck)	$12.40	

Welders-receive rate prescribed for craft performing operation to which welding is incidental.

Certified 7/1/2016

Classifications that are required, but not listed above, must be requested in writing from the Arkansas Department of Labor, Prevailing Wage Division. Please call (501) 682-4536 for a request form.

Power Equipment Operators:

Group I

Operators engaged in operating the following equipment: Cranes, draglines, shovels and piledrivers with a lifting capacity of 50 tons or over, and operators of all tower climbing cranes and derricks required to work 25 feet or over from the ground, blacksmith and mechanics.

Group II

Operators engaged in operating the following equipment or performing work relative to the engineer's jurisdiction: Hydraulic cranes, cherry pickers, backhoes, and all derricks with a lifting capacity less than 50 tons, as specified by the manufacturer, all backhoes, tractor or truck type, all overhead & traveling cranes, or tractors with swinging boom attachments, gradealls all above equipment irrespective of motive power, leverman (engineer), hydraulic or bucket dredges, irrespective of size, trackhoes, excavators.

Group IV

Light Equipment Operators. Operators engaged in operating the following equipment: Oilerdriver motor crane, single drum hoists, winches and air tuggers, irrespective of motive power, winch or A frame trucks, rollers of all types and pull tractors, regardless of size, elevator operators inside and outside when used for carrying workmen from floor to floor and handling building material, Lad-A-Vator Conveyor, batch plant, and mortar or concrete mixers, below 10S, end dump euclid, pumpcrete spray machine and pressure grout machine, air compressors, regardless of size. All light equipment, welding machines, light plants, pumps, all well point system dewatering and portable pumps, space heaters, irrespective of size, and motive power, equipment greaser, oiler, mechanic helper, drilling machine helper, asphalt distributor and like equipment, safety boat operator and deckhand.

STATEMENT OF INTENT TO PAY PREVAILING WAGES

PROJECT: **FORREST CITY NEW CITY HALL**
FORREST CITY, ARKANSAS
ST FRANCIS COUNTY

This is to certify that we, the following listed contractors, are aware of the wage requirements of the Arkansas Prevailing Wage Law and by signature below indicate our intent to pay no less than the rates established by **Arkansas Prevailing Wage Determination Number 16-261** for work performed on the above noted public project. I understand that contractors who violate prevailing wage laws, i.e., incorrect classification/scope of work of workers, improper payments of prevailing wages, etc., are subject to fines and will be required to pay back wages due to workers.

	Business Name	Address	Phone#	Signature and Title of Business Official
General/Prime Contractor				
Electrical Subcontractor				
Mechanical Subcontractor				
Plumbing Subcontractor				
Roofing/ Sheet Metal Subcontractor				

THE GENERAL/PRIME CONTRACTOR IS RESPONSIBLE FOR GETTING THIS FORM FILLED OUT AND RETURNING IT TO THE ARKANSAS DEPARTMENT OF LABOR ***WITHIN 30 DAYS OF THE NOTICE TO PROCEED*** FOR THIS PROJECT. RETURN COMPLETED FORM TO THE ARKANSAS DEPARTMENT OF LABOR, PREVAILING WAGE DIVISION, 10421 W. MARKHAM, LITTLE ROCK, ARKANSAS, 72205.

SECTION 00700 - GENERAL CONDITIONS

ARTICLE 1 -- GENERAL PROVISIONS

1.1 DEFINITIONS

1.1.1 Contract Documents: Contract Documents consist of Agreement with Proposal and Bid Bond attached; Bonds; General and Supplementary Conditions; Specifications; Drawings; Addenda issued prior to execution of the Contract; other documents listed in the Agreement; and modifications issued after execution of the Contract, signed by both parties.

1.1.2 Contract: The Contract Documents form the Contract for construction. The Contract Documents will not be construed to create a contractual relationship between the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and Contractor, between the Owner and a subcontractor, between the Owner and [Architect] [Engineer] [Landscape Architect] [Design Consultant], or between entities other than the Owner and Contractor; however, a contractual relationship does exist between the Contractor and the agency referred to as Owner.

1.1.3 Work: Construction and services required by the Contract Documents whether completed or partially completed, include tools, labor, equipment, supplies, transportation, handling, and incidentals provided by the Contractor.

1.1.4 Project: The total improvement program described in the Contract Documents.

1.1.5 Drawings: Graphic and textual portions of the Contract Documents showing the design, location, and dimensions and size of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

1.1.6 Specifications: Written requirements for materials, equipment, systems, standards, and workmanship for the Work, and performance of related services.

1.1.7 Project Manual: Volume which may include the bidding requirements, forms, contracting requirements, and the Technical Specifications.

1.1.8 Owner: The person or entity identified as such in the Contract Agreement, referred to throughout the Contract Documents as singular in number. The term Owner means the Owner or the Owner-authorized representative.

1.1.9 Owners Representative: A designated representative of the Owner will perform all duties and obligations hereinafter assigned to the Owner.

1.1.10 Contractor: The person or entity identified as such in the Contract Agreement, referred to throughout the Contract Documents as singular in number. The term Contractor means the Contractor or the Contractor-authorized representative.

1.1.11 {Architect] [Engineer] [Landscape Architect] [Design Consultant] [A] [E] [LA] [DC]: The person or entity identified as such in the Agreement, lawfully licensed to practice architecture or engineering and under contract to Owner to provide design service, advice, and consultation, referred to throughout the Contract Documents as if singular in number. The term [A] [E] [LA] [DC] means the {Architect] [Engineer] [Landscape Architect] [Design Consultant] [Owner] or the authorized representative.

1.1.12 Subcontractor: Any person, firm, or corporation with a direct contract with the Contractor who acts for or in behalf of the Contractor in executing a portion of the Work. The term subcontractor is referred to as singular in number and means the subcontractor or the subcontractor-authorized representative.

1.1.13 Inspector: A duly authorized representative of the [Architect] [Engineer] [Landscape Architect] [Design Consultant], designated for detailed inspection of materials, construction, workmanship, and methods of construction.

1.1.14 Site: The particular location of that part of the project being considered.

1.2 INTENT

1.2.1 The intent of the Contract Documents is to set forth the standards of construction, the quality of materials and equipment, the guarantees that are to be met, and to include items necessary for proper execution and completion of the Work. The Contract Documents are complementary and what is required by one will be as binding as if required by all. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable as necessary to produce indicated results.

1.2.2 Organization of the Specifications into divisions, sections, and articles, and arrangement of Drawings will not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

1.2.3 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 CAPITALIZATION

1.3.1 Terms capitalized in the Contract Documents include those which are specifically defined, the titles to numbered sections and articles, identified references to paragraphs, and the titles of other published documents.

1.4 INTERPRETATION

1.4.1 Whenever in these Contract Documents the words "as ordered", "as directed", "as required", "as permitted", "as allowed", or words or phrases of like import are used, it shall be understood that the order, direction, requirement, permission, or allowance of the Owner and [Architect] [Engineer] [Landscape Architect] [Design Consultant] is intended.

1.4.2 Whenever in these Contract Documents the word "product" is used, it shall be understood that the materials, systems, and equipment will be included.

1.4.3 Whenever in these Contract Documents the word "provide" is used, it shall be understood that it means to "furnish and install".

1.4.4 The Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

ARTICLE 2 -- OWNER

2.1 LAND

2.1.1 The Owner will provide the lands shown on the Drawings upon which the Work shall be performed. The Owner will provide a right-of-way for access to the project site.

2.1.2 The Owner will provide base lines for the location of the principle component parts of the Work with a suitable number of bench marks adjacent to the Work.

2.2 RIGHT OF ENTRY BY OWNER

2.2.1 The Owner and his authorized representative will have the right to enter the property or location on which the Work shall be constructed. The Owner further reserves the right to construct or have his authorized agents construct such work as the Owner will desire, so long as these operations do not interfere with or delay the work being constructed under this Contract.

2.3 OWNER'S RIGHT TO CARRY OUT THE WORK

2.3.1 If the Contractor defaults or neglects to perform the Work in accordance with the Contract Documents, including the requirements with respect to the schedule of completion, and fails after ten days written notice from the Owner to correct the deficiencies, the Owner may deduct the cost thereof from the payment then or thereafter due the Contractor.

ARTICLE 3 -- CONTRACTOR

3.1 GENERAL

3.1.1 The Contractor shall perform the Work in accordance with the Contract Documents.

3.1.2 The Contractor shall furnish labor, materials, equipment, and transportation necessary for the proper execution of the work unless specifically noted otherwise. The Contractor shall do all the work shown on Drawings and described in Specifications and all incidental work considered necessary to complete the project in a substantial and acceptable manner, and to fully complete the work or improvement, ready for use, occupancy and operation by the Owner. Drawings and Specifications shall be interpreted by the [Architect] [Engineer] [Landscape Architect] [Design Consultant].

3.1.3 The Contractor shall cooperate with the Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], inspectors, and with other contractors on the Project. Contractor shall allow inspectors acting in an official capacity, to have access to the project site.

3.1.4 The Contractor shall determine that the final and completed work on the project is in accordance with the Contract Documents. The failure of the [Architect] [Engineer] [Landscape Architect] [Design Consultant] to find or correct errors or omissions in the use of materials or work methods during the progress of the work shall not relieve the Contractor from his responsibility to correct all the defects in the project.

3.1.5 The Contractor shall assist in making final inspections and shall furnish such labor and equipment as may be required for the final tests of equipment, piping, and structures.

3.2 REVIEW OF FIELD CONDITIONS

3.2.1 Before ordering material or doing Work, the Contractor shall verify all measurements involved and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the measurements indicated on Drawings; differences which may be found, shall be submitted to [Architect] [Engineer] [Landscape Architect] [Design Consultant] for consideration before proceeding with the Work.

3.2.2 Drawings may show the location or existence of certain exposed and buried utilities as well as existing surface and subsurface structures. The Owner assumes no responsibility for failure to show any or all such utilities and structures on the Drawings or to show such in the exact location. It is mutually agreed such failure will not be considered sufficient basis for claims for extra work or for increasing the pay quantities in any manner unless the obstruction encountered necessitates substantial changes in the lines or grades or requires the building of a special structure.

3.3 REVIEW OF CONTRACT DOCUMENTS

3.3.1 The Contractor shall study and compare Drawings, Specifications, and other instructions and shall report to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] at once any error, inconsistency, or omission discovered.

3.3.2 In the event of conflict among the Contract Documents, interpretations will be based on the following order of precedence:
a. The Agreement
b. Addenda, with those of later date having precedence
c. Supplementary Conditions
d. General Conditions
e. Drawings and Specifications

3.3.3 Since the Contract Documents are complementary, the Contractor shall take no advantage of any apparent error or omission in the Drawings and Specifications. The Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall furnish interpretations as deemed necessary for the fulfillment of the intent of the Drawings and Specifications.

3.3.4 Discrepancies found between the Drawings and Specifications and actual site conditions or any errors or omissions in the Drawings or Specifications shall be immediately reported to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] who shall address such error or omission in writing. Work done by the Contractor after discovery of such discrepancies, errors, or omissions shall be at the Contractor's risk and expense.

3.4 REQUEST FOR SUPPLEMENTARY INFORMATION

3.4.1 The Contractor shall make timely requests of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant] for additional information required for the planning and production of the Work. Such requests shall be submitted as required, but shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay.

3.4.2 Additional instructions may be issued by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] during the progress of the Work to clarify the Drawings and Specifications or as may be necessary to explain or illustrate changes in the Work.

3.5 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

3.5.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

3.5.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

3.5.3 Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

3.5.4 The Contractor shall provide shop drawings and other submittals, settings, schedules, and other drawings as may be necessary for the prosecution of the Work in the shop and in the field as required by the Drawings, Specifications, or [Architect] [Engineer] [Landscape Architect] [Design Consultant] instructions.

3.6 LABOR AND MATERIALS

3.6.1 Except as otherwise specifically stated in the Contract, the Contractor shall provide, but not be limited to, all materials, labor, tools, equipment, water, light, heat, power, transportation, superintendence, temporary construction of every nature, taxes legally collectible because of the work, and all other services and facilities of every nature whatsoever necessary to complete the Work in accordance with the Contract Documents in an orderly and efficient manner. The sequence of construction operations shall follow the schedule of construction as approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The Work shall not be discontinued by the Contractor without approval of the [Architect] [Engineer] [Landscape Architect] [Design Consultant]. Should prosecution of the Work be discontinued for any reason, the Contractor shall notify the [Architect] [Engineer] [Landscape Architect] [Design Consultant] at least twenty-four hours in advance of resuming the Work.

3.6.2 Materials and equipment furnished under this Contract will be subject to inspection by the Owner's authorized representative or by independent laboratories. Defective material, equipment, or workmanship may be rejected at any time before the acceptance of the Work even though the defective material, equipment, or workmanship may have been previously overlooked and estimated for payment. The Contractor shall replace defective equipment and material in accordance with the Contract Documents at no additional cost to the Owner.

3.6.3 The Contractor shall provide materials and supplies not subject to conditional sales agreements, bailment lease, or other agreement reserving unto the seller any right, title, or interest therein. All materials and supplies shall become the property of the Owner upon final acceptance of this Contract by the Owner.

3.6.4 If shop tests are to be conducted, the Contractor shall notify the Owner of such tests so a representative may witness tests, if desired.

3.6.5 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the [Architect] [Engineer] [Landscape Architect] [Design Consultant], and in accordance with a Change Order.

3.7 UNAUTHORIZED WORK

3.7.1 Work done without lines and grades having been given or work done beyond the lines or not in conformity with the grades shown on the Drawings or as provided by the Owner, except as provided herein, and work completed without proper inspection and supervision or any extra or unclassified work completed without written authority and prior agreement shall be at the Contractor's risk. Such unauthorized work, at the option of the [Architect] [Engineer] [Landscape Architect] [Design Consultant], may not be measured and paid for and may be ordered removed at the Contractor's expense.

3.8 SUPERINTENDENCE

3.8.1 The Contractor shall supervise and direct the Work. The Contractor shall be solely responsible for construction means, methods, techniques, sequences, and procedures and for coordinating portions of the Work under the Contract. The Contractor shall maintain the workplace as a drug free work area. From time to time Owner may require drug test report.

3.8.2 The Contractor shall employ a qualified and experienced (in similar project type and magnitude) superintendent during the duration of the Project who is acceptable to the Owner and [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The superintendent shall be maintained on the Project and give efficient supervision to the Work until completion. The superintendent shall be capable of reading and understanding the Drawings and Specifications and shall have full authority to act in behalf of the Contractor. All directions and instructions given to the Superintendent shall be considered as given to the Contractor and shall be as binding as if given to the Contractor.

3.8.3 Workmanship shall be performed by workmen experienced in their trade and skilled and experienced for the class of work to which assigned. Any person, including supervisory personnel, who does not show and exhibit skill and proficiency in said work shall be removed by the Contractor and replaced by a competent and experienced workman.

3.8.4 The Contractor shall, at all times, be responsible for the conduct and discipline of his employees and all Subcontractors and their employees. Disorderly, incompetent or intemperate persons, or persons who commit any crimes or trespass on public or private property in the vicinity of the Work must not be employed, retained, or allowed upon the project. Any foreman or workman employed by the Contractor or a Subcontractor who refuses or neglects to comply with the instructions of the Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], or inspector shall, at the written request of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant], be discharged immediately and shall not be employed again in any portion of the Work without the approval of the Owner.

3.8.5 The Contractor shall coordinate Work by the various trades to provide uniform and symmetrical layout and spacing of the exposed components which will affect the finished design and appearance. Where spacing and related locations are not specifically shown on Drawings or where in doubt, the Contractor shall consult the [Architect] [Engineer] [Landscape Architect] [Design Consultant] prior to installation of that part of the Work.

3.9 PERMITS, FEES, AND NOTICES

3.9.1 The Contractor shall purchase and secure all drawings and specifications, permits and licenses and give all notices necessary and incidental to the prosecution of the Work.

3.9.2 When new construction under the Contract crosses highways, railroads, streets or utilities under the jurisdiction of the state, county, city, or other public agency, public utility, or private entity, the Contractor shall secure written permission from the proper authority before executing such new construction. A copy of this written permission shall be filed with the Owner before any work is completed. The Contractor shall furnish a release from the proper authority before final acceptance of the Work. Any bonds required for this Work shall be secured and paid for by the Contractor.

3.10 SAMPLES AND TESTS

3.10.1 The Contractor shall provide samples, materials, and equipment necessary or required for testing as outlined in the various sections of the Specifications or as directed by the Owner. The Contractor shall pay costs for testing. Should materials, methods, or systems fail to meet

specified standards, the Contractor shall pay all costs for additional testing as required by the Owner.

3.10.2 All tests shall be made by a laboratory approved by the Owner.

3.11 LOCATION, GRADIENT, AND ALIGNMENT

3.11.1 Based upon the site information provided by the Owner, the Contractor shall develop and make detailed surveys necessary for construction including slope stakes, batter boards, and other working points, lines and elevations.

3.11.2 The Contractor shall report any errors, inconsistencies, or omissions to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] as a request for information.

3.11.3 The Contractor shall preserve bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor, shall be responsible for damage or mistakes resulting from unnecessary loss or disturbance.

3.12 LAND

3.12.1 Additional land and access thereto not shown on Drawings that may be required for temporary construction facilities or for storage of materials shall be provided by the Contractor at his expense with no liability to the Owner. The Contractor shall confine his equipment and storage of materials and the operation of his workmen to those areas shown on the Drawings and described in the Specifications, and such additional areas which he may provide or secure as approved by the Owner.

3.12.2 The Contractor shall not enter upon private property for any purpose without first obtaining permission.

3.12.3 The Contractor shall be responsible for the preservation of and prevent damage or injury to all trees, monuments, and other public property along and adjacent to the street and right-of-way. The Contractor shall prevent damage to pipes, conduits and other underground structures, and shall protect from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location, and shall not remove monuments or property marks until directed.

3.13 LIMITS OF WORK

3.13.1 The Contractor shall conduct Work and operations so as to cause a minimum of inconvenience to the public. At any time when, in the opinion of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant], the Contractor is obstructing a larger portion of a road, street, or other public right-of-way than is necessary for the proper execution of the Work, the [Architect] [Engineer] [Landscape Architect] [Design Consultant] may require the Contractor to finish the sections on which work is in progress before work is commenced on any new sections.

3.14 WARRANTY

3.14.1 The Contractor shall warrant that all Work, materials, and equipment furnished will be free from defects in design, materials, and workmanship and will give successful service under the conditions required. The warranty period for Work, materials, and equipment furnished by the Contractor shall be one year from the date of the written acceptance of the Work or the date that the Owner signs the final payment request.

3.15 PATENTS AND ROYALTIES

3.15.1 If the Contractor is required or desires to use any design, device, material or process covered by letters, patent, or copyright, he shall provide for such use by suitable legal agreement with the patents or Owner. It is mutually understood and agreed that without exception the Contract Sum shall include all royalties or costs arising from patents, trademarks, and copyrights in any way involved in the Work. The Contractor and the surety shall defend, indemnify, and save harmless the Owner and all its officers, agents and employees from all suits, actions, or claims of any character, name and description brought for or on account of infringement or alleged infringement by reason of the use of any such patented design, device, material or process of any trademark or copyright used in connection with the Work agreed to be performed under this Contract, and shall indemnify the Owner for any cost, expense, or damage which it may be obliged to pay by reason of any action or actions, suit or suits which may be commenced against the Owner for any such infringement or alleged infringement at any time during the prosecution or after the completion of the Work contracted for herein. It is mutually agreed that the Owner may give written notice of any such suit to the Contractor, and thereafter, the Contractor shall attend to the defense of the same and save and keep harmless the Owner from all expense, counsel fees, cost liabilities, disbursements, recoveries, judgements, and executions in any manner growing out of, pertaining to, or connected therewith.

3.16 CLEANING UP

3.16.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractors tools, construction equipment, machinery, and surplus materials.

3.16.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

ARTICLE 4 -- ADMINISTRATION OF CONTRACT

4.1 [Architect] [Engineer] [Landscape Architect] [Design Consultant] AUTHORITY

4.1.1 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will interpret the requirements of the Contract Documents and decide matters concerning performance thereunder on request of the Owner or Contractor.

4.1.2 Work shall be performed under the general administration of the [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will decide any and all questions as to the acceptability of materials or equipment furnished, work performed, interpretation of the Drawings and Specifications, rate of progress of the Work, acceptability of the quality of workmanship provided, and other questions as to the fulfillment of the Contract by the Contractor.

4.1.3 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will prepare change orders and may authorize minor changes in the Work.

4.1.4 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] and his authorized representatives will have the right to enter the property or location on which the Work shall be constructed.

4.2 CLAIMS

4.2.1 Definition: A claim is a demand or assertion by one of the parties seeking adjustment, or interpretation of Contract terms, payment of money, extension of time, or other relief with respect

to the terms of the Contract. The term includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims will be initiated by written notice. The responsibility to substantiate claims shall rest with the party making the claim.

4.2.2 Claims of the Contractor or the Owner: Claims regarding the Work of the Contract shall be referred initially to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] for a decision. The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will review claims, and 1) reject in whole or in part; 2) approve the claim; 3) suggest a compromise; 4) advise the parties that the [Architect] [Engineer] [Landscape Architect] [Design Consultant] is unable to resolve the claim.

4.2.3 Claims for Concealed or Unknown Conditions: If new and unforeseen items of work are discovered, which cannot be covered by any item or combination of items for which there is a Contract Sum, then the Contractor shall notify the [Architect] [Engineer] [Landscape Architect] [Design Consultant] before conditions are disturbed. The Contractor shall complete such work and furnish such materials as may be required for the proper completion or construction of the work contemplated upon written Change Order from the [Architect] [Engineer] [Landscape Architect] [Design Consultant] as approved by the Owner. Work shall be performed in accordance with the Contract Documents.

4.2.4 Claims for Extensions of Time: The Contractor shall provide written notice to [Architect] [Engineer] [Landscape Architect] [Design Consultant] within ten days stating the cause of the delay and request an extension of Contract Time. The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will act on the request in writing. The extension of time shall be for a period equivalent to the time lost by reasons indicated.

4.2.5 Claims for Changes in the Work: The Contractor shall provide written notice to [Architect] [Engineer] [Landscape Architect] [Design Consultant] within ten days after the receipt of instructions from the Owner, as approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant], to proceed with changes in the Work and before such Work is commenced. Changes in the Work shall not be commenced before the claim for payment has been approved, except in emergencies endangering life or property. The Contractor's itemized estimate sheets showing labor, material, equipment, overhead, profit, insurance and any other cost shall be submitted to the [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The Owner's order for changes in the Work shall specify any extension of the Contract Time and one of the following methods of payment:

a. Unit prices or combinations of unit prices which formed the basis of the original Contract.
b. A lump sum fee based on the Contractor's estimate, approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and accepted by the Owner..
c. The actual cost of the Work plus an allowance of 12 percent and 5 percent for the General Contractor/Subcontractor respectively.

4.2.6 Claims for Additional Costs: In case of an emergency which threatens loss or injury of property or safety of life, the Contractor shall be allowed to act, without previous instructions from the [Architect] [Engineer] [Landscape Architect] [Design Consultant], in a diligent manner. The Contractor shall notify the [Architect] [Engineer] [Landscape Architect] [Design Consultant] immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] for consideration. The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided under these General Conditions.

ARTICLE 5 -- SUBCONTRACTORS

5.1 ASSIGNMENT OF CONTRACT

5.1.1 Neither the Owner nor the Contractor shall have the right to sublet, sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof without written consent of the other party. No assignment, transfer, or subletting, even with the proper consent, shall relieve the Contractor of his liabilities under this Contract. Should any Assignee or Subcontractor fail to perform the work undertaken by him in a satisfactory manner, the Owner has the right to annul and terminate the Assignee's or Subcontractor's contract on the project.

5.2 SUBCONTRACTS

5.2.1 The subcontracting of the whole or any part of the Work to be done under this Contract will not relieve the Contractor of his responsibility and obligations. All transactions of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall be with the Contractor. Subcontractors will be considered only in the capacity of employees or workmen and shall be subject to the same requirements as to character and competency.

5.2.2 The Contractor shall discharge or otherwise remove from the project any Subcontractor that the Owner or the [Architect] [Engineer] [Landscape Architect] [Design Consultant] may object to as incompetent or unfit.

5.2.3 The Contractor may not change Subcontractors without the written approval of the Owner. The Contractor shall not be relieved of any liabilities under this Contract, but shall be fully responsible for any Subcontractor or work by said Subcontractor where Subcontractor is employed by the Contractor to perform work under this Contract. Nothing contained in the Contract Documents shall create contractual relations between any Subcontractor and the Owner.

5.2.4 No officer, agent, or employee of the Owner, including the [Architect] [Engineer] [Landscape Architect] [Design Consultant], shall have any power or authority to bind the Owner or incur any obligation in his behalf to any Subcontractor, material supplier or other person in any manner whatsoever.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OTHER CONTRACTS

6.1.1 The Owner reserves the right to award other contracts in connection with the Project. The Contractor shall cooperate with the other contractors with regard to the storage of materials and equipment, access to the site, and execution of their work. It shall be the Contractor's responsibility to inspect the work of other contractors which will affect the work of this Contract and to report to the Owner irregularities which will not permit him to complete his work in a satisfactory manner or in the time allotted. Failure to so report shall constitute an acceptance of the work of other contractors.

6.2 DEPENDENCE ON OTHERS

6.2.1 If any part of the Contractor's work depends for proper execution or results upon the work of the Owner or any separate contractor, the Contractor shall, prior to proceeding with the work, promptly report to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] any apparent discrepancies or defects in such other. work that render it suitable for such proper execution and results. Failure of the Contractor to so report shall constitute an acceptance of the work.

ARTICLE 7 -- CHANGES IN THE WORK

7.1 GENERAL

7.1.1 The Owner may, as the need arises, without invalidating the Contract, order changes in the work in the form of additions, deletions, or modifications. Compensation to the Contractor for additional work or to the Owner for deductions in the work and adjustments for the time of completion shall be adjusted at the time of ordering such change.

7.1.2 Additional work shall be done as ordered in writing by the Owner. The order shall state the location, character, and amount of extra work. All such work shall be executed under the conditions of the Contract, subject to the same inspections and tests.

7.1.3 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] and the Owner reserve and shall have the right to make changes in the Contract Documents and the character or quantity of the work as may be considered necessary or desirable to complete fully and acceptably the proposed construction in a satisfactory manner.

7.2 CHANGE ORDERS

7.2.1 A Change Order is a written instrument, prepared by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and approved by the Owner stating their agreement upon:
a. Description and details of the work.
b. Estimated amount of the adjustment in the Contract Sum.
c. Estimated extent of the adjustment in the Contract Time.

7.3 PAYMENT FOR CHANGES IN THE WORK

7.3.1 All changes in the Work will be paid for in the manner indicated in Article 4, Paragraph 4.2, and the compensation thus provided shall be accepted by the Contractor as payment in full for the use of small tools, superintendent's services, premium on bond, and all other overhead expenses incurred in the prosecution of such work.

ARTICLE 8 -- TIME

8.1 DEFINITIONS

8.1.1 Contract Time is the period of time, including authorized adjustments, identified in the Contract Documents for Substantial Completion of the Work.

8.1.2 Date for commencement of the Work is the fifth day following the date of mailing, by regular mail, of the Notice to Proceed, unless otherwise stated in the Contract.

8.1.3 Date of Substantial Completion is the date certified by the [Architect] [Engineer] [Landscape Architect] [Design Consultant].

8.2 PROGRESS

8.2.1 Time limits identified in the Contract Documents are of the essence of the Contract. The Contractor confirms that the Contract Time is a reasonable period of time for performing the Work.

8.3 HOLIDAYS

8.3.1 New Year's Day, Robert E. Lee/Dr. Martin Luther King's Birthday, George Washington's Birthday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and the day after Thanksgiving Day, Christmas Eve and Christmas Day will be considered as being holidays; no other days will be considered. No engineering supervision will be furnished on legal holidays,

Saturdays and Sundays, and no work shall be performed on these days except in an emergency or with written approval in advance.

8.4 DELAYS

8.4.1 Delays beyond the Contractor's control occasioned by an act or omission on the part of the Owner, strikes, fires, additions to the work, delays by any separate contractor employed by the Owner, extremely abnormal weather conditions, or other delays beyond the Contractors control may entitle the Contractor to an extension of time in which to complete the work. While such delays may be just cause for an extension of the Contract Time, the Contractor shall not have a claim for damages or any such cause or delay.

ARTICLE 9 -- PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contractor shall accept the compensation, as herein provided, in full payment for furnishing all materials, equipment, labor, tools, and incidentals necessary to complete the Work and for performing all Work contemplated and embraced under the Contract; also for loss or damage arising from the nature of the Work, from the action of the elements or from any unforeseen difficulties which may be encountered during the prosecution of the Work until the final acceptance by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and Owner and for all risks of every description connected with the prosecution of the Work, for all expenses incurred in consequence of the suspension or discontinuance of the Work as specified, for any infringement of patent, trademark, or copyright, and for completing the Work according to the Contract Documents. Neither the payment of any estimate nor of any retained percentage shall relieve the Contractor of any obligation to make good any defective work or material.

9.1.2 No moneys payable under Contract or any part thereof, except the estimate for the first month or period, shall become due and payable if the Owner so elects until the Contractor shall satisfy the said Owner that he has fully settled or paid for all materials and equipment used in or on the Work and labor done in connection therewith, and the Owner, if he so elects, may pay any or all such bills wholly or in part and deduct the amount or amounts so paid from any monthly or final estimate excepting the first estimate.

9.1.3 In the event the surety on any contract or payment bond given by the Contractor becomes insolvent, or is placed in the hands of a receiver, or has the right to do business in a state revoked as provided by law, the Owner may at its election withhold payment of any estimate filed or approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] until the Contractor shall give a good and sufficient bond in lieu of the bond so executed by such surety.

9.2 SCHEDULE OF VALUES

9.2.1 The Contractor shall submit to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] a schedule of values for each part of the Work. The schedule shall be a complete breakdown of labor and materials for the various parts of the Work including an allowance for profit and overhead. The total of these amounts shall equal the Contract Sum. The approved schedule of values shall be used as a basis for the monthly payments to the Contractor. In applying for the monthly payment, the Contractor shall show a detailed account of work accomplished in conformity with the schedule.

9.3 MEASUREMENT OF QUANTITIES

9.3.1 The Contractor shall be paid for all Work performed under the Contract based on [Architect] [Engineer] [Landscape Architect] [Design Consultant] computations of as-built quantities and the

Contractor's Contract Sum. This payment shall be full compensation for furnishing all supplies, materials, tools, equipment, transportation, and labor required to do the Work; for all loss or damage, because of the nature of the Work, from the action of the elements or from any unforeseen obstruction or difficulty which may be encountered in the prosecution of the Work and for which payment is not specifically provided for all or any part of the Work; and for well and faithfully completing the Work in accordance with the Contract Documents. The method of computation and payment for each item shall be as set forth in the Specifications or the Supplementary Conditions.

9.4 REQUESTS FOR PAYMENT

9.4.1 The Contractor may submit periodically, but not more often than once each month, a Request for Payment for work completed. When unit prices are specified in the Contract Documents, the Request for Payment shall be based on the quantities completed.

9.4.2 Unless otherwise provided in the Contract Documents, payments will be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site, and if approved in advance by the Owner, payments may similarly be made for materials or equipment suitably stored at some other location agreed upon in writing. Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest including applicable insurance and transportation to the site for those materials and equipment stored off the site.

9.4.3 The Contractor shall furnish the [Architect] [Engineer] [Landscape Architect] [Design Consultant] all reasonable facilities and job tickets required for obtaining the necessary information relative to the progress and execution of the Work and the measurement of quantities. Each Request for Payment shall be computed from the work completed on all items listed in the approved schedule of values less 10 percent of the first 50 percent of the adjusted Contract Sum and less previous payments to the Contractor on the Contract.

9.5 PERIODIC ESTIMATES FOR PAYMENT

9.5.1 Unless otherwise stated in the Supplementary Conditions, the Contractor shall prepare an Estimate for Payment to the Owner each month. This Estimate for Payment, except for final estimates, shall not be made if the amount due the Contractor is less than $1,000. The Contractor will make the estimate for the materials complete in place and the amount of work performed in accordance with the Contract between the twenty-fifth day of the month and the fifth day of the succeeding month.

9.5.2 From the total of the amount estimated to be paid, an amount equal to 10 percent of the total completed shall be retained until the Contract is 50 percent complete after which no further retainage will be withheld from the monthly estimates. All sums withheld by the Owner will be paid to the Contractor within 30 days after the Contract has been substantially completed. No retainage will be withheld on that amount of the progress payment pertaining to the cost of materials stored at the site.

9.6 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

9.6.1 When alterations in the quantities of work not requiring Contract modifications are ordered and performed, the Contractor shall accept payment in full at the Contract Sum, for the actual quantities of work accomplished. No allowance will be made for anticipated profits. Increased or decreased work involving Contract modifications shall be paid for as stipulated in such Contract modifications.

9.7 [Architect] [Engineer] [Landscape Architect] [Design Consultant]'S ACTION ON A REQUEST FOR PAYMENT

9.7.1 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will, within ten working days plus time required for transmittal from one party to another, act on a Request for Payment by the Contractor in one of the following:
a. Approve the Request for Payment as submitted by the Contractor.
b. Approve an adjusted amount as the [Architect] [Engineer] [Landscape Architect] [Design Consultant] will decide is due the Contractor informing the Contractor in writing of the reason for the adjusted amount.
c. Withhold the Request for Payment submitted by the Contractor informing the Contractor in writing of the reason for withholding the request.

9.8 OWNER'S ACTION ON A REQUEST FOR PAYMENT

9.8.1 The Owner will, within five working days, act on a Request for Payment after approval by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] by one of the following:
a. Pay the Request for Payment as approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant].
b. Pay an adjusted amount as the Owner will decide is due the Contractor informing the Contractor and the [Architect] [Engineer] [Landscape Architect] [Design Consultant] in writing of the reason for the adjusted amount of payment.
c. Withhold the Request for Payment informing the Contractor and the [Architect] [Engineer] [Landscape Architect] [Design Consultant] in writing of the reason for withholding the payment.

9.9 BLANK- RESERVED

9.10 WITHHOLDING PAYMENT

9.10.1 The Owner may withhold payment, and the [Architect] [Engineer] [Landscape Architect] [Design Consultant] may withhold a Request for Payment in whole or in part to the extent necessary for the protection of the Owner from loss on account of any of the following causes discovered either before or subsequent to [Architect] [Engineer] [Landscape Architect] [Design Consultant] approval of a Request for Payment:
a. Defective work on the project.
b. Evidence indicating the probable filing of claims by other parties against the Contractor.
c. Damage caused to another contractor.
d. Reasonable evidence that Work cannot be completed for the unpaid balance of the Contract Sum or within the Contract Time.
e. Failure of the Contractor to make payments on materials, equipment, or labor or to subcontractors.

9.11 PAYMENT FOR UNCORRECTED WORK

9.11.1 Should the [Architect] [Engineer] [Landscape Architect] [Design Consultant] direct the Contractor not to correct work that has been damaged or that was not performed in accordance with the Contract Documents, an equitable deduction from the Contract Sum shall be made to compensate the Owner for the uncorrected work. The [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall determine the amount of the equitable deduction.

9.12 PAYMENT FOR REJECTED MATERIALS AND WORK

9.12.1 The removal of rejected Work and materials and the re-execution of acceptable work by the Contractor shall be at the expense of the Contractor. The Contractor shall pay the cost of

replacing the work of other contractors destroyed or damaged by the removal of the rejected work or materials and the subsequent replacement with acceptable work.

9.13 DATE OF SUBSTANTIAL COMPLETION

9.13.1 A Certificate of Substantial Completion, which shall establish the Date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to work, and insurance and shall fix the time within which the Contractor shall complete the items listed therein. Warranties required by the Contract Documents shall commence on the Date of Substantial Completion.

9.14 FINAL COMPLETION AND PAYMENT BY OWNER

9.14.1 The Contractor shall furnish a letter from the [Architect] [Engineer] [Landscape Architect] [Design Consultant] attached to the Contractor's final estimate which certifies that the [Architect] [Engineer] [Landscape Architect] [Design Consultant] has received and approved all guarantees, bonds, maintenance and operation manuals, air balance data, shop drawings, catalog data, and record documents specified in the Contract Documents.

9.14.2 Before final payment, the Contractor shall furnish to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] executed copies of the Release of Liens. Items mentioned shall be submitted with and at the same time as the final estimate to the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and shall be promptly delivered by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] to the Owner; no final payment can be made without complete compliance.

9.15 PARTIAL OCCUPANCY OR USE

9.15.1 The Owner may occupy or use any completed or partially completed portion of the Work provided such use or occupancy is consented to by the insurer and authorized. The Contractor will prepare a list of items to be completed or corrected before partial acceptance. Upon receipt of the Contractors list, the [Architect] [Engineer] [Landscape Architect] [Design Consultant] will make an inspection to determine whether the Work or portion thereof is substantially complete.

9.15.2 The [Architect] [Engineer] [Landscape Architect] [Design Consultant] will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix the time within which the Contractor shall complete the items listed therein. Warranties required by the Contract Documents shall commence on the Date of Substantial Completion.

9.16 FINAL INSPECTION

9.16.1 Tests, inspections, and approvals of portions of the Work required by the Contract Documents, laws, ordinances, or any public authority having jurisdiction shall be made at the appropriate time. The Contractor shall give the [Architect] [Engineer] [Landscape Architect] [Design Consultant] timely notice of when and where tests and inspections shall be made so that the [Architect] [Engineer] [Landscape Architect] [Design Consultant] may be present. The Contractor shall make arrangements for the testing and inspection with an independent testing laboratory.

9.16.2 The Contractor shall ensure that the final completed work is in accordance with the Contract Documents. Required certificates of testing and inspection shall be secured by the Contractor and delivered to the [Architect] [Engineer] [Landscape Architect] [Design Consultant], unless otherwise required by the Contract Documents.

9.17 ASSIGNMENT OF WARRANTIES

9.17.1 All warranties of materials and workmanship running in favor of the Contractor shall be transferred and assigned to the Owner on completion of the Work and at such time as the Contractor receives final payment.

9.17.2 In case of warranties covering work performed by subcontractors, such warranties shall be addressed to and in favor of the Owner. The Contractor shall be responsible for delivery of such warranties to the Owner prior to final acceptance of the work.

9.17.3 Delivery of guarantees or warranties shall not relieve the Contractor from any obligation assumed under any provision of the Contract. All warranties shall be for one year from the date of Substantial Completion of the Project.

9.18 ACCEPTANCE AND FINAL PAYMENT

9.18.1 Upon receipt of written notice that the Work is ready for final inspection, the [Architect] [Engineer] [Landscape Architect] [Design Consultant] will conduct such inspection and when the [Architect] [Engineer] [Landscape Architect] [Design Consultant] finds the Work acceptable, the [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall certify his acceptance to the Owner of the Contractor's final Request for Payment. This payment shall be the Contract Sum plus approved additions less approved deductions and less previous payments made. The Contractor shall furnish evidence that he has fully paid all debts for labor, materials, and equipment incurred in connection with the Work. The Owner will accept the Work and release the Contractor, except as to the conditions of the Performance and Maintenance Bond, any legal rights of the Owner, required guarantees and correction of faulty work after Final Payment, and shall authorize payment of the Contractor's final Request for Payment. The Contractor must allow sufficient time between the time of completion of the work and approval of the final Request for Payment for the [Architect] [Engineer] [Landscape Architect] [Design Consultant] to assemble and check the necessary data.

9.18.2 Acceptance of final payment by the Contractor shall constitute waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of the final Request for Payment.

ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY

10.1 GENERAL

10.1.1 The Contractor shall at all times exercise precaution for the safety of employees on the Project and of the public, and shall comply with all applicable provisions of federal, state and municipal safety laws and applicable building and construction codes. The Contractor shall provide and maintain passageways, guard fences, lights, and other facilities for protection required by all applicable laws. All machinery, equipment, and other physical hazards shall be guarded in accordance with all federal, state or municipal laws or regulations.

10.1.2 The Work, from commencement to completion, and until written acceptance by the [Architect] [Engineer] [Landscape Architect] [Design Consultant], or to such earlier date or dates when the Owner may take possession and control, shall be under the charge and control of the Contractor and during such period of control by the Contractor, all risks in connection therewith shall be borne by the Contractor. The Contractor shall make good and fully repair all injuries and damages to the Project caused by any other casualty or cause whether or not the same shall have occurred by reason of the Contractor's negligence. The Contractor shall adequately protect adjacent Property as provided by law and the Contract Documents. The Contractor shall hold the

Owner harmless from any and all claims for injuries to persons or for damage to property during the control by the Contractor of the project or any part thereof.

10.1.3 The Contractor shall at all times so conduct the Work as to ensure the least possible obstruction to traffic, to the general public, and the residents in the vicinity of the Work, and to ensure the protection of persons and property. No road, street, or highway shall be closed to the public except with the permission of the Owner and proper governmental authority. Fire hydrants on or adjacent to the Work shall be kept accessible to fire fighting equipment at all times. The local fire department shall be notified of the temporary closing of any street.

ARTICLE 11 -- INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall secure and maintain in force during this Contract such insurance from an insurance company authorized to write the prescribed insurance in the jurisdiction where the

Project is located as will protect the Contractor, his subcontractors, and the Owner from claims for bodily injury, death, or property damage which may arise from operations under this Contract. The Contractor shall not commence work under this Contract until he has obtained all the insurance required, has filed the Certificate of Insurance with the Owner, and the certificate has been approved by the Owner. Each insurance policy shall contain a clause providing that it shall not be canceled by the insurance company without written notice to the Owner of intention to cancel.

11.1.2 Workman's Compensation and Employer's Liability Insurance in statutory limits shall be secured and maintained as required by the laws of the State of Arkansas. This insurance shall cover all employees who have performed any of the obligations assumed by the Contractor under these Contract Documents including Employer's Liability Insurance. This insurance shall protect the Contractor against any and all claims resulting from injuries, sickness, disease, or death to employees engaged in work under this Contract.

11.1.3 Comprehensive General Liability Insurance, including automobile and truck liability. Prior to blasting, the Contractor shall furnish Certificate of Insurance which shall certify that damage caused by blasting is within the coverage of his Comprehensive General Liability Insurance to the full limits thereof. Hired and nonowned automobile insurance for automobiles and trucks shall include hired and nonowned automobile coverage.

11.1.4 Contractor's Protective Liability Insurance: The Contractor shall indemnify and save harmless the Owner from and against all losses and all suits, claims, demands, judgements, actions, and payments of every description and nature brought or recovered against him by reason of any omission or act of the Contractor, his agents, or employees in the execution of the Work or in the guarding of it. The Contractor shall secure and maintain protective liability insurance in the name of the Owner and the Contractor covering them from contingent liability under this Contract.

11.1.5 Builder's Risk and Fire Insurance: The Contractor shall procure and maintain during the life of this Contract Builder's Risk Insurance fire, lightning, extended coverage, vandalism, and property theft on the insurable portion of the Project on a 100 percent completed value basis against damage to the equipment, structures, or material. The Owner and the Contractor, as their interests may appear, shall be named as the Insured.

11.1.6 Proof of Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this

certificate will not be canceled or materially altered except after 15 days prior written notice has been received by the Owner."

11.2 BONDS

11.2.1 Performance Bond: The Contractor shall, at the time of execution of the Contract, furnish bonds covering faithful performance of the Contract and the payment of obligations. Performance and Payment bonds shall be filed with the circuit clerk office in the County Courthouse of the county where the work shall be performed.

ARTICLE 12 -- UNCOVERING AND CORRECTION OF WORK

12.1 EXAMINATION OF COMPLETED WORK

12.1.1 If any portion of the work should be covered contrary to the request of the Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], or Inspector or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], or Inspector, be uncovered for his observation and replaced at the Contractor's expense.

12.2 DEFECTIVE WORK

12.2.1 Defective work, whether through the use of defective materials, the result of poor workmanship, or any other cause, shall be removed within ten days after notice is given by the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The Work and affected materials and equipment shall be removed and replaced as necessary to comply with the Contract Documents without additional cost to the Owner. The fact that the defective work may have been previously overlooked by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall not constitute acceptance.

12.3 REJECTED MATERIALS

12.3.1 Materials which do not conform to the requirements of the Contract Documents, are not equal to samples approved by the [Architect] [Engineer] [Landscape Architect] [Design Consultant], or are in any way unsuited or unsatisfactory for the purpose for which intended, shall be rejected. Defective materials shall be removed within ten days after notice by the [Architect] [Engineer] [Landscape Architect] [Design Consultant]. The materials shall be replaced with new materials as necessary to comply with the Contract Documents at no additional cost to the Owner. The fact that the defective material may have been previously overlooked by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] shall not constitute acceptance.

12.3.2 Should the Contractor fail to remove and replace rejected material within the specified ten days after written notice to do so, the Owner may remove and replace the material and deduct the cost from the Contract Sum.

12.4 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT

12.4.1 The approval of the final Request for Payment by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] and the making of the final payment by the Owner to the Contractor shall not relieve the Contractor of responsibility to correct faulty materials or workmanship promptly after receipt of written notice from the Owner. The Owner shall give such notice of faulty materials or workmanship promptly, after discovery of the condition. If the Contractor fails to correct the defects, promptly, after receipt of written notice from Owner, the Owner may have the work corrected at the Contractors expense.

ARTICLE 13 -- MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

13.1.1 The Contract shall be governed by the law of the place where the Project is located.

13.1.2 The Contractor shall give all notices and comply with all federal, state, and local laws, ordinances, and regulations in any manner affecting the conduct of the Work. The Contractor shall indemnify and save harmless the Owner against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree whether by himself or his employees.

13.1.3 The Contractor shall comply with the laws of the local, state, and federal government regarding wages and hours of labor.

13.2 WRITTEN NOTICE

13.2.1 Consider as served when delivered in person or sent by certified or registered mail to the individual, firm, or corporation or to the last business address of such known to him who serves the notice.

13.2.2 The written Notice to Proceed with the Work shall be issued by the [Architect] [Engineer] [Landscape Architect] [Design Consultant] after the execution of the Contract by the Owner. The Contractor shall begin and prosecute the Work and uninterruptedly in a manner that will complete the Work within the time limits stated in the Contract.

13.3 TESTS AND INSPECTIONS

13.3.1 All materials and each and every part of the Work shall be subject at all times to inspection by the Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], or the Inspector. The Contractor shall be held to the intent of the Contract Documents in regard to quality of materials, equipment, and workmanship, and the diligent execution of the Contract. The inspection may extend to and include plant, shop, or factory inspection of material furnished.

13.3.2 The Owner, [Architect] [Engineer] [Landscape Architect] [Design Consultant], and the Inspector shall be allowed access to all parts of the Work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection for ascertaining if the Work as performed is in accordance with the requirements and the Contract Documents.

13.3.3 Inspectors shall have authority to suspend any work which is being improperly done, subject to the final decision of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant]. Inspectors shall have no authority to permit deviations, or to relax provisions of the Contract Documents without the written permission or instruction of the Owner or [Architect] [Engineer] [Landscape Architect] [Design Consultant], or delay the Contractor by failing to work with reasonable promptness.

13.4 VERBAL AGREEMENTS

13.4.1 No verbal objection, order, claim, or notice by any of the parties involved to the other parties shall affect or modify any of the terms or obligations contained in the Contract Documents. None of the terms or provisions of the Contract Documents shall be considered waived or modified unless the waiver or modification thereof is in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

ARTICLE 14 -- TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 SUSPENSION OF WORK

14.1.1 The work or any portion thereof may be suspended at any time by the Owner provided that the Owner gives the Contractor written notice of the suspension. The notice shall set forth the date on which the work is to be suspended and the date on which the work is to be resumed. The Contractor shall resume the work upon written notice from the Owner within ten days after the date set forth in the notice of suspension.

14.1.2 The Owner will have the authority to suspend the work, wholly or in part, for such period of time as deemed necessary. The suspension may be due to unsuitable weather, or such other conditions as are considered unfavorable for the proper prosecution of the work, or the failure on the part of the Contractor to fulfill the provisions of the Contract. Failure to supply material, equipment, or workmanship meeting the requirements of the Contract Documents shall be just cause for suspension of the Work. The Contractor shall not have the right to suspend operations without the [Architect] [Engineer] [Landscape Architect] [Design Consultant] or Owner's permission.

14.2 TERMINATION BY OWNER FOR CAUSE

14.2.1 The Owner will have the right to terminate the Contract upon giving ten days written notice of the termination to the Contractor and the Contractors surety, in the event of any default by the Contractor and upon written notice from the [Architect] [Engineer] [Landscape Architect] [Design Consultant] to the Owner that sufficient cause exists to justify such action. In the event of termination of the Contract, the Owner may take possession of the Work and of all materials, tools, and equipment and construction equipment and machinery thereon and may finish the work by whatever method he may select.

14.2.2 It shall be considered a default by the Contractor whenever he shall:

a. Become insolvent, declare bankruptcy, or assign assets for the benefit of his creditors.
b. Fail to provide qualified superintendence, proper materials, competent subcontractors, competent workmen, or fail to make prompt payments for labor, materials, or equipment.
c. Disregard or violate provisions of the Contract Documents or the [Architect] [Engineer] [Landscape Architect] [Design Consultant] instructions, or fail to execute the Work according to the approved schedule of completion, including extensions thereof.
d. Start the work on the date established in the Notice to Proceed.

END OF SECTION

SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

GENERAL:

The following supplements are to be utilized when modifying the "General Conditions of the Contract for Construction", AIA Document A201, Fifteenth Edition, 1997. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. The AIA General Conditions and the Supplementary Conditions are complementary and apply to all Work in every division of these specifications.

ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1, Delete subparagraph 1.1.7 and substitute the following:

1.1.7 The Project Manual

The Project Manual is the volume(s) which include the Bidding Documents, the Conditions of the Contract, the Specifications including Division 1 General Requirements and technical sections of Division 2 through 16, and the Addenda (when issued).

ARTICLE 3 CONTRACTOR

3.4 LABOR AND MATERIALS:

3.4.2 Add the following to the existing paragraph:

"The Contractor shall provide products of specified manufacturers, or products of manufacturers approved during bidding period. After award of Contract, no substitution of products will be considered except under conditions and in the manner specified."

3.4 Add the following new subparagraphs:

3.4.4 "Contractors and Subcontractors employed for the Work shall conform to the labor laws of the State of Arkansas and the various acts amendatory and supplementary to such labor laws, and to such other applicable laws, ordinances and legal requirements."

3.4.5 "Labor shall be performed in the best and most professional manner by mechanics skilled in their respective trades. Standard results shall be first class only."

3.4.6 "Mechanics whose Work is unsatisfactory to the Architect or Owner, or who are considered to be unskilled or otherwise objectionable, shall be instantly dismissed from the Work upon notice from the Architect, Project Manager, or Owner".

3.5 WARRANTY:

3.5.1 Line 4, after "Documents", insert the following:

"and that said equipment is not a discontinued item but is still being manufactured, that replacement parts for same shall be obtainable for the anticipated or stated life of the equipment and, that equipment is not in essence actually, or considered to be, obsolete at the time of installation,".....

3.5 Add the following new subparagraph:

3.5.2 "The Contractor shall absolutely guarantee and warrant Contractor's and Subcontractor's work and materials and materials and work of suppliers of the Contractor and Subcontractors, for a period of one year from date of acceptance of project by Owner. Warranty shall be for a longer period on certain items when so designated in specifications. The foregoing one-year absolute guarantee and warranty shall not in any way limit, restrict, or affect the liability of Contractor or Subcontractors for indemnity as provided for in this Contract, nor shall it in any way shorten the period of limitation fixed by law for filing of any legal action against Contractor for enforcement or for breach of any provision of contract documents. Should Contractor elect to use any of the equipment in the building during construction period, Contractor shall make arrangements with Subcontractor or Supplier of that equipment for any extension of warranty of that equipment made necessary by such use. Warranty period of such equipment to Owner shall not be reduced by use of equipment by Contractor".

3.15 CLEANING UP:

3.15.1 Line 4, after "materials", add:

"Additionally, after the completion of Work, the Contractor shall clear debris from roofs and gutters, clear all drains, replace any broken glass, clean glass, hardware, accessories, and fixtures, vacuum floors, wash tile and special finish floors, dust counters and appliance tops, and, in general, leave the building ready for occupancy."

ARTICLE 5 SUBCONTRACTORS:

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK:

5.2.1 At the end of paragraph, add:

"Within 15 days after award of Contract, submit complete list of Subcontractors proposed for each portion of the Work, including those principal subcontractors identified on the Bid Form, as specified in Instruction to Bidders. Subcontractors shall have and maintain current license from the Arkansas Contractor's License Board".

5.2.3 Add to end of subparagraph:

"No increase in the Contract Sum shall be allowed should a substitution be required as a result of the Owner's or Architect's reasonable objection based on qualifications and requirements included in the Contract Documents."

5.2.5 Add new subparagraph as follows:

"Where provisions of paragraph 5.2 conflict with Act 477 of 1961 of the State of Arkansas, as amended, the provision of Act 477 shall govern."

5.3 SUBCONTRACTURAL RELATIONS:

5.3.1 Add to end of subparagraph:

"Use AIA Document A401, Contractor-Subcontractor Agreement or other appropriate written agreement that is specifically coordinated with the requirements, obligations, and responsibilities of Contract. If requested by Owner, submit copies of such executed agreements".

ARTICLE 7 CHANGES IN THE WORK

7.3 CONSTRUCTION CHANGE DIRECTIVES:

7.3.3 Delete in its entirety and substitute the following:

7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be determined based on one of the methods shown below.

A. All quotations for changes, be they additions or deductions, shall be submitted in a complete itemized breakdown for acceptable to State Building Services using Contract Unit Prices when set forth therein. The value of any and all such additions or deductions shall be determined as set forth in "C", as follows:

B. The itemized breakdown shall show unit quantities and costs of all labor and materials. Submit all verifying data as necessary or required by State Building Services to support claims, such as copies of original invoices, payrolls, etc. The burden of proof cost rests upon the Contractor. Contractor agrees that the State Building Services or Agency's Representative shall have the right, at reasonable times, to inspect and audit the books and records of Contractor to verify the propriety and allowability of such costs.

C. Compute requests for changes be they additions or deductions as follows:

1. For work performed by the Contractor:
   Net costs of Materials----------a
   State Sales Tax----------b
   Net Placing Cost----------c
   W.C. Insurance Premium & FICA Tax--------$\frac{d}{a+b+c+d}$
   Overhead and Profit (15% x (a+b+c+d)-----e
   Allowable Bond Premium----------f

   TOTAL COST a+b+c+d+e+f

2. Credit for work omitted shall be computed as outlined in (1) "a thru e" except the Contractor's share of overhead and profit percentage is 7%.

3. For work performed by sub-contractors . . . . .

   Sub-contractors shall compute their work as outlined in (1), "a" through "e".

   To the cost of that portion of the work (change) that is performed by the subcontractor, the General Contractor shall add an Overhead and Profit Charge of Five Percent (5%) plus the Allowable Bond Premium.

ARTICLE 8 TIME

8.3 DELAYS AND EXTENSIONS OF TIME:

8.3.1 Add at end of subparagraph the statement shown below and then add the following subparagraphs 8.3.1.1 through 8.3.1.8:

"Claims for extension of time for causes enumerated above will be considered valid only under the following conditions:"

8.3.1.1 Only those enumerated conditions over which the Contractor has no control will be considered. The burden of proof to substantiate the claim for an extension shall rest with the Contractor, including evidence that the cause was beyond Contractor's control. It shall be deemed the Contractor has control over the supply of labor, materials, equipment, methods, techniques and over Subcontractors, Sub-subcontractors, and Suppliers.

8.3.1.2 In the event of changes in the Work, any consideration for a time extension will be made only at the time of authorizing the changes, and no later than when the Change Order is prepared, and then only if the change significantly affects the time and progress of the entire Work. For changes which do not affect the entire Work, time extensions may be granted only for the area, phase, unit or element affected by the change, and if due to a valid reason for a time extension.

8.3.1.3 Any unusual delay in transportation will not be considered unless it is due solely to transportation. An extension of time will not be granted for delays in deliveries where said delivery was not properly scheduled or when orders were not properly placed.

8.3.1.4 With respect to a claim for an extension of time as a result of climatic conditions, the Contractor shall recognize the location of the site and the existence, as normal, of variations from "average" conditions. Foul weather in itself will not be a valid reason for a time extension. Requests for time extension because of delay resulting from weather extremes will not be considered unless a substantial variation from usual weather conditions occurs for a significant period of time, during phases of Work when they would otherwise have been in progress. In considering the time extension, the weather conditions both before and after the period in which the delay is claimed will be evaluated with credit given for unseasonably favorable weather.

8.3.1.5 Delays resulting from a labor dispute will not result in a time extension.

8.3.1.6 A delay in the overall project progress actually occurred and clearly disrupted the total project progress as a result of one of the valid causes for time extension. An extension of time for parts, phases or stages may be granted where a valid delay indicates such partial time extension is justified.

8.3.1.7 No time extension will be granted as a result of improper scheduling or for failure to have shop drawings or samples submitted in ample time for review under a reasonable and agreed upon schedule.

8.3.1.8 Delays by Subcontractors, Sub-Subcontractors, or Suppliers will not be considered justification for a time extension, except for the same valid reasons and conditions enumerated under subparagraph 8.3.1.

8.3.3 Delete entirely and substitute the following subparagraph:

"This paragraph 8.3 does not exclude the Owner's recovery of damages for delay under other provisions of the Contract Documents. The Contractor's sole and exclusive remedy for delay is a right to a time extension for completion of the Contract and not damages".

ARTICLE 9 PAYMENTS AND COMPLETION:

9.2 SCHEDULE OF VALUES:

9.2.1 At the end of subparagraph, add: "Submit in accordance with Section 01300".

9.3 APPLICATIONS FOR PAYMENT:

9.3.1 At the end of subparagraph, add: "Submit in accordance with Section 01300".

Add the following paragraphs:

9.3.1.3 "Until Substantial Completion of the Work, 10% of each progress payment will be retained. Refer to Article 9.8.2 for adjustment in retainage upon Substantial Completion of Work".

9.3.1.3.1 "If, in the judgement of Owner, satisfactory progress is being made and maintained in the Work, and if Contractor furnishes Consent Surety to Reduction In or Partial Release of Retainage (AIA Document G707A), retainage may be reduced as follows:

10% of each progress payment will be retained through 50% completion of Work, with additional retainage thereafter reduced to below 10%"

9.3.1.3.2 "The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect, or if the Surety withholds its consent, or for other good and sufficient reasons."

9.4.1 Amend as follows:
"Act 813 of 1977, as amended, allows a maximum processing time for contractor

payment request. The Owner (or Architect if so empowered) is allowed five (5) working days; the state agency board, commission, or institution five (5) working days; Arkansas State Building Services two (2) working days; Department of Finance And Administration five (5) working days. Transmittal times are not included in processing. Failure of any of the above to complete processing within the time allowed can result in a penalty being assessed against the responsible agency. Failure to include this information in the bid documents or specifications shall deem the bid proposal null and void."

The Contractor shall complete and submit SBS ACL-1 with final payment request. Failure to do so will result in a DELAY of payment.

9.8 SUBSTANTIAL COMPLETION:

9.8.5 At the end of the paragraph, add:

"The payment shall be sufficient to increase the total payments to 95 percent of the Contract Sum, less such amounts as the Owner shall determine for all incomplete Work and unsettled claims."

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.2 At the end of the paragraph, add:

"Submit an affidavit of payment of debts and claims and an affidavit of release of liens on AIA Forms G706 and G706A, respectively."

ARTICLE 11 INSURANCE AND BONDS

11.1.1 Add the following sentence:

The amount of such insurance shall be not less than the following or any limits by law.

11.1.1 "General: The Contractor shall not commence Work under this Contract or allow any subcontractor or anyone directly or indirectly employed by any one of them to commence Work until Contractor has obtained all insurance required under this section and duly executed certificates of such insurance have been filed with the Architect and approved by the Owner and Owner's agent. All insurance policies, certificates and endorsements shall be submitted to the Architect in duplicate, one copy of which will be retained by the Architect and the other forwarded to the Owner or Owner's agent".

11.1.2 Workmen's Compensation Insurance: The Contractor shall procure and maintain at Contractor's expense during the term of the Contract, Workmen's Compensation

Insurance and Employer's Liability Insurance for all of Contractor's employees engaged at the site of the Work, in accordance with the statutes of the State of Arkansas. In case any hazardous occupations are required above stated insurance, a special Employer's Liability policy shall be procured and maintained by the Contractor during the term of the Contract to cover workmen engaged in such hazardous occupations".

11.1.3

a. State	Statutory
b. Applicable Federal	Statutory
c. Employer's Liability	Per Accident:$ 500,000.00
	Disease, Policy Limit:$ 500,000.00
	Disease, Each Employee:$ 500,000.00

11.1.3.2 Add the following clause:
11.1.3.2 Commercial General Liability

General Aggregate: $ 2,000,000.00

Completed Operations: Aggregate:$1,000,000.00
(to be maintained for one year after final payment)

Personal Injury: Each Occurrence:$1,000,000.00

Each Occurrence Limit: Each Occurrence:$1,000,000.00

Automobile Liability: Combined Single Limit:$1,000,000.00
(including owned, non-owned, and hired vehicles)

Umbrella Excess Liability: $1,000,000.00

Subparagraph 11.1.4, add the following clause:
Owner's and Contractor's
Protective Liability: Combined Single Limit: $1,000,000.00

Subparagraph 11.1.5:
Builder's Risk or Installation Floater Policy: $ = Contract Amount

Contractor shall Deliver to the Owner a copy of each Insurance policy for his review and approval prior to the issuance of the Notice to Proceed and any work being performed.

Please note: Policy Certificates shall state "The insurance covered by this certificate will not be cancelled, or materially altered except after 15 days prior written notice has been received by the Owner."

11.7 "The required insurance must be written by a company licensed to do business in the State of Arkansas at the time the policy is issued. In addition, the companies must be acceptable to the Owner and Owner's agent".

11.8 "The Contractor shall not cause any insurance to be canceled nor permit any insurance to lapse. All insurance policies shall contain a clause to the effect that the policy shall not be canceled, or reduced, restricted, or limited, until 15 days after the Owner and Owner's agent have received written notice as evidenced by return receipt of registered or certified letter. Certificates of insurance shall contain transcripts from the proper office of the insurer, evidencing in particular those insured, the extent of the insurance, the location, and the operations to which the insurance applies, the expiration date, and the above mentioned notice of cancellation clause".

11.9 The following extension clause shall be incorporated in the Builder's Risk Policy: "Insured elects to extend the insurance provided by this policy for a period of 30 days beyond the date of completion of the Work or date of occupancy, but not beyond expiration date of this policy".

11.5 PERFORMANCE BOND AND PAYMENT BOND:

11.5.1 Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder in compliance with Arkansas Act 351 of the Acts of 1953. Bonds must be issued by a Surety licensed to do work in the state in which the project is located. Cost shall be included in the Contract Sum. The amount of each bond shall be equal to 100% of the Contract Sum.

11.5.1.1 The Contractor shall deliver the required bonds to the Owner no later than 10 days following the date of Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

11.5.1.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

11.5.1.3 File a copy of the bonds with the Circuit Clerk in the County in which the project is located.

<u>ARTICLE 13</u> MISCELLANEOUS PROVISIONS

13.6 Interest: Delete in its entirety.

Add the following paragraphs:

13.8 Equal Opportunity:

13.8.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. The Contractor shall take affirmative action to insure that applicants are employed, and the employees are treated during employment without regard to their race, religion, color, sex, national origin, or age. Such action shall include, but not be limited to the following: employment, upgrading, demotion or termination; rates of pay or other forms 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 policies of non-discrimination.

13.8.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, include a statement that all applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

Add the following paragraphs:

14.4 Termination by the Owner for Convenience:

14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

1. Cease operations as directed by the Owner in the notice;

2. Take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

3. Except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts or purchase orders.

END OF SECTION

SECTION 01000 - GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

Furnish all required labor, equipment, and materials to complete all work in accordance with the drawings and specifications.

1.2 DEFINITIONS

Whenever the specifications require approval or selection of any item, it shall be construed to mean approval or selection by the Engineer. Whenever the specifications require submittal of reports or certifications, it shall be construed to mean submitted to the Engineer.

Approvals made by the Owner prior to final project inspection and acceptance do not relieve the Contractor from his obligation to perform the work in accordance with the specifications and drawings. These approvals do not prohibit the Owner from subsequently asserting any other contract rights under this contract.

A. Locations of Work
The work to be performed is at the following location: Batesville, Arkansas.

B. Principal Features
The work to be performed includes site clearing, grading, paving, drainage, etc.

1.4 SUBMITTALS

A. Product Data
Submittals shall be furnished to ETC Engineers & Architects, Inc. 1510 South Broadway, Little Rock, Arkansas. 72202 RE: Forrest City New City Hall, no later than 15 days after contract award, prior to the installation of the submitted materials and equipment. Submittals shall be approved by the Engineer, in writing, prior to the installation of the submitted materials and equipment. A seven day review period may be anticipated upon receipt of Contractor furnished submittals to the Engineer.

Submittals shall include shop drawings, certifications, manufacturer's literature, samples, etc., sufficient in detail to show full compliance with this contract document.

Contractor shall mark all submittals to show specific equipment or materials to be furnished under this contract.

If shop drawings show variations from the contract requirements, the Contractor shall, in writing, describe such variations and the reasons therefore, separate from the drawings, at the time of submittal.

In lieu of the label or listing of a specified agency (UL, FM, etc.) a written certificate from an approved, nationally recognized testing organization may be submitted. The testing organization shall be equipped to perform such services and shall certify that the items have been tested and conform to the requirements and testing methods of the specified agency.

B. Product Format
Submittals shall consist of two separately bound copies, placed in a hard cover binder, with each technical section separated by tabbed dividers. The dividers shall be keyed to an index inserted in the front of the binder.

Three copies of the submittal will be returned to the Contractor after the Engineer has reviewed it.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Access to Sites
Access to the sites will be from 6:30 A.M. to 5:30 P.M., Monday through Friday, unless other arrangement agreed upon with the site manager.

B. Excavation
Prior to start of the work, the contractor must contact utility companies. Any work without authorization to excavate will be shut down.

C. Protection
The Contractor shall provide signs, barriers, and barricades to provide a safe work area.

1.6 PRE-FINAL DEFICIENCY LIST

A. All work shall be coordinated with ETC Engineers & Architects, Inc. at (501) 375-1786

B. Prior to the completion of the work, the Owner/Engineer will furnish to the Contractor a list of all known project deficiencies. All deficiencies shall be corrected by the Contractor prior to final payment.

C. Owner, Engineer, or his authorized representative, will conduct the final inspection and certify completion of the project to the Owner.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION (Not applicable)

END OF SECTION

SECTION 01010 - SUMMARY OF WORK AND PROCEDURES

1.01 DEFINITIONS

A. Contractor: The Party of the first part of the contract

B. Owner: City of Forrest City
224 North Rosser Street
Forrest City, AR 72335

C. Architect: ETC Engineers & Architects, Inc.
1510 So. Broadway
Little Rock, Arkansas 72202

1.02 FORM OF AGREEMENT

The "Standard Form of Agreement" A.I.A. Document A-101 shall be the Form of Agreement between Contractor and Owner. The Agreement takes place over all other Contract Documents.

1.03 NOTICE TO PROCEED

Do not begin work prior to receipt of written Notice to Proceed authorizing performance of the Contract for each Project.

1.04 PAYMENTS TO CONTRACTOR

A. Partial payments to include the value of materials delivered to site and labor executed shall be paid by Owner to Contractor in monthly installments upon Architect's certificate as work progresses in proportion to amount of work executed during monthly period, and in accordance with Article 9, Supplementary Conditions.

B. Deliver six (4) copies of monthly application for payment to Architect. Include six (4) copies of the updated Progress Schedule with Payment Request.

C. After payment, submit receipted invoices from all Subcontractors and Material Suppliers, certifying that payment has been made in full, less 10%.

1.05 PROGRESS SCHEDULE

Submit copies of Progress Schedule in accordance with Section 01300, Submittals & Substitutions.

1.06 CONSTRUCTION DOCUMENTS

The Contractor is to supply all contract drawings and specifications to his subcontractors or material suppliers. Additional sets or portions of contract drawings and specifications requested by the Contractor will be furnished for actual cost of printing at the Contractor's expense.

1.07 ORDERS FOR MATERIALS

A. Place material orders within ten (10) days after execution of Contract. Furnish evidence of orders to Architect upon request.

B. Place orders contingent upon selection of colors and finishes, approval of shop drawings and samples by Architect.

C. Include with monthly request for payment and progress schedule a report of materials purchased and date materials are scheduled for delivery.

1.08 SUBSTITUTIONS OF MATERIAL, EQUIPMENT OR METHODS

Proposals for substitutions of material, equipment or methods shall be submitted no later than thirty (30) days from date of written Notice to Proceed authorizing performance of the Contract.

1.09 SUBCONTRACTOR LIST

Submit list of proposed Sub-contractors to Architect in accordance with Article 5, Supplementary Conditions. Do not award any Sub-contract without Architect's prior approval. This list does not refer only to subcontractors named in the Bid Form. It should include all of the subcontractors.

1.10 GUARANTEES

A. Guarantee all work to be free from defects in materials and workmanship for a period of one (1) year from date of authorization of final settlement except where a different time period is specifically prescribed.

B. When, at any time during the guaranty period, work is considered defective by either Owner or Architect, immediately:

1. Place such defective work into satisfactory condition, free from faults and defects and in conformance with Contract requirements.

2. Make good all damage to work, including contents thereof and grounds, developing within guaranty period when such damage is due to use of materials and labor not conforming to Contract requirements.

3. Make good all work disturbed in fulfillment of Contract obligations during guaranty period. If work of other contractors is disturbed in the process of fulfilling Contract, restore such work to it original condition and guarantee such restored work.

C. Upon failure by Contractor to proceed promptly to comply with terms of any guaranty under the Contract, Owner shall have such work performed as necessary to fulfill guarantees, and Contractor shall pay Owner such sums as expended to fulfill such guaranty.

D. Work required for fulfillment of guarantees embraced under the Contract shall be performed at no additional expense to Owner.

1.11 CONTRACT TIME

Perform all work necessary to bring entire Contract, Base Bid work, and its individual Projects, to state of final completion in not more than the time listed in the Bid Form.

1.12 WORK PERFORMED BY OWNER

A. Owner Furnished, Contractor Installed Items:

1. The Owner will purchase and deliver item to site. The Contractor shall unload, uncrate, assemble, and provide utilities and hook-up, as required for complete and operational installation.

2. Refer to plans for items that are Owner Furnished, Contractor Installed:

1.13 COORDINATION

A. Provide administrative and supervisory requirements necessary for coordination of work, including meetings, administrative and supervisory personnel, survey, records, reports, limitations for use of site, installation provisions, cutting and patching, cleaning, protection, conservation, and salvage. Coordinate work with work performed by Owner, including storage of materials and equipment, and connections and execution of work.

END OF SECTION

SECTION 01020 - SPECIAL CONDITIONS

1.01 GENERAL: The GENERAL CONDITIONS form a part of this Section.

1.02 EXAMINATION OF SITE:

A. Each bidder shall visit the site of the Work, compare the Drawings and Specifications with any work in place, and inform himself of all conditions. Failure to visit the site will in no way relieve the successful bidder from necessity of furnishing materials or performing any work that may be required to complete Work in accordance with Drawings and Specifications, without additional cost to the Owner.

B. Take special care to verify all existing conditions, elevations, lines and dimensions. Prior to submitting bids or commencing work, report any dimensional variations, discrepancies, obvious omissions, or other conditions materially affecting performance of the work in accordance with requirements indicated in Drawings and Specifications.

1.03 PROJECT LIMITS: The Contractor shall confine his operation, other than work required in the installation of utilities, drainage, etc., to the area indicated on the plans.

1.04 CODES: All Work shall be performed to meet the requirement of applicable local, state and national codes and other agencies having jurisdiction.

1.05 PROTECTION: Protect Work from injury due to weather, frost, dampness, accident and other like causes.

1.06 TEMPORARY JOB OFFICES:

A. The Contractor shall furnish and maintain:

1. A job office to accommodate Contractor and Architect. Substantially constructed with floors above grade. Provide heat, light, and ventilation. A suitable travel trailer may be substituted in lieu of job constructed office space. Locate as directed by the Owner.

B. Maintain on file in job office: Copies of Drawings, and Specifications, supplemental drawings or data, shop drawings, approved samples, and records pertinent to the Project.

C. Do not store tools, materials, supplies and equipment in job office.

D. Telephone and Facsimile: Provide telephone and fax in the field office. Pay costs for temporary service.

1.07 STORAGE SHEDS: Provide temporary, substantially constructed, dampproof storage sheds for materials and tools. Locate as directed.

1.08 SANITARY FACILITIES: Contractor shall provide temporary toilets, as required.

1.09 UTILITIES:

A. Make necessary arrangements for all temporary and permanent electric services for lighting and power as required. The Contractor shall coordinate with all local utility companies for utilities to be relocated during construction.

B. Provide temporary and permanent water, gas, and sewer connections as required.

C. Refer to Mechanical and Electrical plans and specifications for additional information concerning construction utilities.

D. The Contractor shall pay all fees associated with temporary and permanent utility connections.

1.10 LAYING OUT WORK:

A. Employ a Civil Engineer to lay out the work. Verify grades, levels and dimensions indicated on Drawings. Report any errors or inconsistencies to Architect in writing before commencing work.

B. Provide and maintain well built batterboards at all corners of new construction, establish bench marks at not less than two widely separated locations, locate all general reference points and take such action necessary to prevent their destruction.

C. Employ a professional Civil Engineer or Land Surveyor registered in the state of Arkansas, and approved by the Architect, to confirm or define site boundaries and/or building lines. Erect substantial bench marks and preserve them throughout the work.

1.11 BARRICADES AND SIGNS:

A. Provide and maintain lights, public barriers, and barricades, as required for

protection of persons and property in accordance with local codes and good safety practices. The Contractor is solely responsible for the safety on the Project.

B. Provide and maintain such signs required by safety regulations and necessary to safeguard life and property.

1.12 RESPONSIBILITIES OF CONTRACTOR:

A. Except as otherwise specifically stated in the Contract, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, heat, power, transportation, superintendence, permits, fees, temporary construction of every nature, taxes legally collectible because of the work and all other services and facilities of every nature whatsoever necessary to execute the Work to be done under the Contract and deliver it complete in every respect within the specified time.

B. If work is required in a manner to make it impossible to produce first class work, or should discrepancy appear among Contract Documents, request interpretation before proceeding with work. If Contractor fails to make such request, no excuse will thereafter be entertained for failure to carry out work in a satisfactory manner.

C. Should conflict occur in or between Drawings and Specifications, the Contractor is deemed to have estimated on more expensive way of doing work unless he shall have asked for and obtained a written decision before submission of Proposal as to which method of materials will be required.

1.13 FILE DRAWINGS: At the completion of this project, the General Contractor shall furnish to the Architect, and to the Owner, a complete file of the final copies of all shop drawings used in the construction of this project.

1.14 COORDINATION: In the interest of expediting the Work, it shall be the responsibility of the Contractor to coordinate the work of all trades. The Contractor shall increase his forces, work overtime, or take other measures necessary in order to protect the Work or complete certain portions of the Work within the established time for the Project at no additional cost to the Owner under the Base Contract.

A. Provide administrative and supervisory requirements necessary for coordination of work, including meetings, administrative and supervisory personnel, survey, records, reports, limitations for use of site, installation provisions, cutting and patching, cleaning, protection, conservation, and salvage.

B. Coordinate construction activities included under various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain its best results.

2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

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

C. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings. Prepare similar memoranda for the Owner and separate contractors where coordination for their work is required.

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

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project close-out activities.

E. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.

F. Coordinate work with work performed by Owner and separate contractors, including storage of materials and equipment, and connections and execution of work.

1.15 ASSIGNMENT OF WORK: The terms "this Contractor" and "this Sub-Contractor" have not been used in this Specification. Whenever the term "Contractor" is mentioned within this Specification, it shall not be interpreted to imply that work required of various sub-contractors is assigned to other sub-contractors of the General Contractor.

1.16 ELECTRICAL LICENSE REQUIREMENT:

A. No person shall perform electrical work on the contract without possessing an Arkansas State Master or Journeyman License from the Arkansas State Electrical Examiners Board. All electrical work and apprentice electricians shall be supervised by a Master or Journeyman Electrician on a one-to-one ratio.

B. All electricians shall have a copy of their license with them and shall be required to show it to an appropriate inspector upon request.

1.17 INSPECTION: The Contractor awarded this Project agrees to allow any Federal or State Inspector, acting in their official capacity, to have access to the job site.

1.18 CERTIFICATIONS: Provide all required certifications for all systems as required in the Contract Price, including but not limited to mechanical, electrical, plumbing.

1.19 SUPERINTENDENT: Prior to start of work, the Contractor shall submit in writing to the Architect/Owner, the qualifications of the Superintendent for approval. If the Architect/Owner finds the Superintendent is unacceptable for any reason, the Contractor shall provide one which is acceptable.

1.20 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the Contract Documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the Contract Documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at project site for reference.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer to requirements that are different, but apparently equal and uncertainties as to which quality level is more stringent to the Architect for decision before proceeding.

D. Copies of Standards: The Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.

1.21 CONSTRUCTION AIDS: Provide and maintain for the duration of construction temporary equipment and apparatus including scaffolds, elevators and hoists, canopies, tarpaulins, barricades, warning signs, steps, ladders, platforms, ramps, chutes, and other temporary construction aids and miscellaneous facilities as necessary for proper completion of the work; comply with pertinent safety regulations.

1.22 TEMPORARY HEAT: Provide temporary heat where indicated and where needed for the proper performance of work, for curing or drying of work recently installed, and protection of work in place from, adverse effects of low temperature.

1.23 DEWATERING AND SNOW AND ICE REMOVAL: Maintain site, excavations, and construction free of water, snow and ice, as necessary for protection and execution of the work. Comply with dewatering requirements specified in Division 2 Specification Sections; where feasible, utilize same facilities.

1.24 TEMPORARY FIRE PROTECTION: During construction period and until fire protection needs are fulfilled by permanent facilities, provide and maintain types and forms of temporary fire protection needed to protect facilities against fire losses. Store combustible materials in recognized fire-safe locations and containers.

1.25 SECURITY: Provide sufficient control to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other controls as required during working hours.

1.26 RODENT CONTROL: Institute an effective program of rodent control. Provide marked metal containers for edible rubbish and enforce their use by employees. Empty containers and remove contents from site as often as required to maintain an adequate rodent control program. If this program of rodent control is not effective, additionally provide for regular services of an experience exterminator who shall visit the site at least once a month for entire construction period.

1.27 REMOVAL: Maintain construction facilities and temporary controls as long as needed for safe and proper completion of Work. Remove temporary facilities and controls as rapidly as progress of Work will permit or as directed by Architect.

END OF SECTION

SECTION 01030 - ALLOWANCES

PART 1 - GENERAL

1.01 SCOPE: The Contractor shall include in Contract Sum all Allowances stated in the Contract Documents.

The Contractor shall include in the Base Bid all allowances named in the Contract Documents and shall cause the work so covered to be done by such contractors and for such sums as the Architect may direct, the Contract Sum being adjusted in conformity therewith. The Contractor declares that the Contract Sum include such sums for expenses and profit on account of cash allowances as he deems proper. No demand for expenses or profit other than those included in the Contract Sum shall be allowed.

1.02 ALLOWANCES

A. Allow the sum of $500 for Interior Signage, in accordance with Section 10440, Interior Signs.

1.03 ADJUSTMENTS OF COSTS: If the costs are more or less than the specified amount of Allowance, the Contract Sum will be adjusted accordingly by change order.

1.04 Allowance shall not be made a part of any subcontract agreement by Contractor until all materials stipulated have been selected by Architect.

END OF SECTION

SECTION 01200 - PROJECT MEETINGS

1.01 PRE-CONSTRUCTION MEETING:

A. Architect will schedule and administer a pre- construction meeting within 15 days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties.

C. Attendance:

1. Owner's Representative.
2. Architect and his professional consultants.
3. Contractor's Superintendent.
4. Major Subcontractors.
5. Others as appropriate.

1.02 PROGRESS MEETINGS:

A. Contractor shall schedule regular periodic meetings, as required by progress of the Work.

B. Location of the meetings: The Project field office of the Contractor.

C. Attendance:

1. Architect and his professional consultants as needed.

2. Subcontractors and suppliers as appropriate to the agenda.

D. Representative of the Contractor, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

E. Architect may attend meetings to ascertain that Work is expedited consistent with Contract Documents and the construction schedules.

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE: Provide all submittals, including shop drawings, product data, samples, schedules, reports, and requests for substitutions, as required by the Bidding and Contract Documents and in strict accordance with the provisions of this section.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Contractual Requirements for Submittals:
Section 00700: General Conditions
Section 00800: Supplementary Conditions

B. Individual Submittals Required: Pertinent sections of these specifications.

C. Contract Closeout: Section 01700

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS:

A. Submit required shop drawings drawn to a scale sufficiently large enough to show all pertinent features of the item and its method of connection to the Work. Submit related shop drawings together; partial submittals will not be accepted. Provide manufacturer's name and model number of prefabricated items and indicate methods of attachment and clearances required relative to other trades affecting all elements of the Work. Identify deviations from the Contract Documents (if any), check dimensions, check that trades have been coordinated and that no conflict will develop in this installation. Notify the Architect in writing of any errors or deviations at the time of submittal. Any dimensional or coordination problems which surface during construction due to lack of coordination by the General Contractor will be corrected at the Contractor's expense. After reviewing the shop drawings, indicate Contractor's approval by signing and dating on Contractor's stamp. The use of stamps which pass on responsibility to subcontractors will not be allowed. The General Contractor is responsible for review and coordination of all aspects of the work, and shall indicate that submittals have been reviewed for dimensions and coordination of all subcontractor work. Failure to follow these procedures will result in rejection of the submission and no additional contract time will be allowed for delay of this cause.

B. Submit one transparency and one print of Contractor's stamped and approved shop drawings for Architect's review. The Architect will review the transparency, and stamp it with indication of action as appropriate. The Architect will retain the print for his record, and will return the transparency to the Contractor. For transparencies marked "Revise and Resubmit, Rejected", correct the original drawings, make a new transparency reproduction and print, and resubmit. For transparencies returned "Reviewed, Furnish as Corrected", provide such number of prints of the transparency as may be needed for field distribution.

2.02 PRODUCT DATA AND SAMPLES: Submit three (3) copies of product data for Architect's review for items specified in the various specification sections (five copies required for mechanical and electrical data). Submit samples, where specified, along with product data. Mark data clearly to indicate exact items submitted, and note deviations from Contract Documents (if any). After reviewing the submittals, indicate approval by signing and dating on Contractor's stamp, and submit to the Architect for review.

2.03 PROGRESS SCHEDULE:

A. Prior to signing the Contract, submit to the Architect a bar chart progress schedule indicating a time for each trade for operation of work to be performed at the site. Chart shall demonstrate planned work, properly sequenced and intermeshed and all critical dates to complete work, for expeditious completion of Work. Indicate all critical dates for Owner furnished items, either Owner installed or General Contractor installed. Identify phases if required. Contractor's schedule shall become a part of the Contract.

B. Submit with application for payments monthly updates of the schedule accurately depicting actual progress to the first day of the month. Indicate percentage of completion on the time bars at 10% increments.

2.04 SCHEDULE OF VALUES: Submit a schedule of values on AIA Document G703 (Continuation Sheet for G702). Itemize separate line cost for each major item of work and each subcontracted item of work (use Sections under Division 2 through 16 in Table of Contents as a basis for listing).

2.05 APPLICATION AND CERTIFICATE FOR PAYMENT: Submit Application and Certificate for Payment on AIA Document G702 and G703. Refer to Section 01370, Schedule of Values, Part 2, Paragraph A.

2.06 MANUAL: Upon completion of the Work and prior to final payment, submit to the Architect a loose-leaf hard cover binder with the project name printed on it, containing five indexed sections as follows:

A. Subcontractors: A listing of all subcontractors for the project, including portions of the Work done, address and telephone number of the firm, and contact at the firm familiar with the Project.

B. Guaranties and Warranties: One fully executed copy of each guaranty and warranty specified.

C. Certificates: One fully executed copy of each certificate specified.

D. Instructions: One operating, service, and maintenance manual or instruction sheet for each item specified.

E. List of As-Built Drawings, Record Drawings, Shop Drawings, Product Data, and Samples.

2.07 DRAWINGS AND SUBMITTALS PACKAGE: Upon completion of the Work and prior to final payment, submit to the Architect a package labeled with the project name and containing one copy of all final record drawings, specifications, shop drawings, product data, and samples (see AIA A201 paragraph 3.11.1). This package and the manual will be presented by the Architect to the Owner upon completion of the Project.

PART 3 - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS: Completely identify each submittal and re-submittal by showing at least the following information. Submittals not properly identified are subject to return without review.

A. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

B. Name of project as it appears in these specifications.

C. Drawing number and specifications section number to which the submittal applies.

D. Number each submittal consecutively.

END OF SECTION

SECTION 01310 - SUBSTITUTION REQUEST FORM

Mail to: ETC Engineers & Architects, Inc.
1510 South Broadway
Little Rock, Arkansas
Phone: 501-375-1786 Fax: 501-375-1277

SECTION ____ PARAGRAPH ____ SPECIFIED ITEM:
PROPOSED SUBSTITUTE:

Attach complete description, designation, catalog or model number, Spec/Data Sheet, and other technical data, including laboratory tests, if applicable.

Fill In Blanks Below:

1. Will substitution affect dimensions indicated on Drawings?

2. Will substitution affect wiring, piping, ductwork, etc., indicated on Drawings?

3. What affect will substitution have on other trades?

4. Differences between proposed substitutions and specified items?

5. If necessary, will the undersigned pay for Architect's cost, required to revise working drawings, caused by substitution?

6. Manufacturer's warranties of specified items and proposed items are: [ ] Same
[ ] Different (explain)

7. Does substitution come in same colors, patterns, etc., as specified item, if applicable?

Submitted By: Signature:
Date:

Firm:
Address:

Telephone:
Fax:

REVIEW COMMENTS:
(Architect's Use Only)

[ ] Accepted
[ ] Accepted As Noted
(see attached copy)
[ ] Not Accepted
[ ] Received Too Late

By:
Date:
Remarks:

SECTION 01370 - SCHEDULE OF VALUES

PART 1 - GENERAL

A. Prior to the first Application for Payment, the Contractor shall submit to the Architect, an expanded Schedule of Values which will define labor and material separately for each significant portion of the work to be performed.

B. Upon request of the Architect, Contractor shall support the values with date, which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Architect, shall be used only as the basis for the Contractor's Applications for Payment.

PART 2 - FORM AND CONTENT OF SCHEDULE OF VALUES

A. Submit schedule of AIA Document G703, Contractor's standard forms and automated printout will be considered for approval by Architect upon Contractor's request.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents of this Project Manual as the format for listing component items. Identify each line item with the number and title of the respective major section of the specifications.

D. For each major line item list sub-values of major products or operations under the item.

E. For items on which progress payments will be requested for stored materials, break down the value into:

1. The cost of the materials, delivered and unloaded, with taxes paid.

2. The total installed value.

F. The sum of all values listed in the schedule shall equal the total Contract Sum.

END OF SECTION

SECTION 01400 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified testing, except where designated otherwise in the respective Specification sections.

B. Testing laboratory services are required for, but are not necessarily limited to, the following:

1. Soil testing and compaction control.

2. Cast-in-place concrete: Curing and testing of molded cylinders.

3. Concrete paving: Density of compacted base for paving.

1.02 RELATED WORK:

A. Related requirements in other parts of the Project Manual:

Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: General Conditions of the Contract.

B. Related requirements specified in other sections:

1. Certification of products: The respective sections of Specifications.

2. Test, adjust and balance of equipment: The respective sections of Specifications.

3. Laboratory tests required, and standards for testing: Each specification section listed.

1.03 QUALITY ASSURANCE:

A. The testing laboratory employed by the Owner will meet "Recommended Requirements for Independent Laboratory Qualification" published by the American Council of Independent laboratories.

B. In its work on this project, the testing laboratory will be required to meet the basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".

1.04 SUBMITTALS:

Submit written report of each test and inspection to the following:

A. Architect/Engineer.

B. Contractor.

C. Project Record file at job site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DUTIES OF TESTING LABORATORY:

A. Cooperate with Architect and Contractor; provide qualified personnel after due notice.

B. Perform specified inspections, sampling and testing of materials and method of construction:

1. Comply with specified standards.

2. Ascertain compliance of materials with requirements of Contract Documents.

C. Promptly notify Architect and Contractor of observed irregularities or deficiencies of work or products.

D. Promptly submit copies of the written report of each test and inspection as required in Article 1.04 above.

3.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY:

A. The testing laboratory is not authorized to:

1. Release, revoke, alter or enlarge on the requirements of the Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

3.03 CONTRACTOR'S RESPONSIBILITIES:

A. Cooperate with laboratory personnel and provide access to the Work and to Manufacturer's Operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the proposed design mix to be used for concrete and other material mixes which require control by the testing laboratory.

D. Furnish copies of Products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to the Work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test specimens.

F. Notify the laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

G. Provide all required time within the construction schedule for the testing laboratory to perform its tests and to issue each of its findings.

H. Provide at the site three extra standard test cylinder molds for emergency use.

END OF SECTION

SECTION 01410 - ENVIRONMENT PROTECTION

1.1 GENERAL REQUIREMENTS

The Contractor shall perform the Work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. The environmental resources within the Project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this Contract.

A. Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

B. Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 15 days after receipt of the Notice to Proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

1. Location of the solid waste disposal area.

C. Stormwater Pollution Prevention Plan

The Contractor shall provide and comply with stormwater pollution plan developed by Engineer. (Not included in this contact.)

D. Permits

The Contractor shall obtain all needed permits or licenses. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

E. Notification

The Architect/Engineer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or

regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Architect/Engineer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Architect/Engineer may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

F. Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Architect/Engineer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Architect/Engineer in the administration of the contract under the contract clause SUSPENSION OF WORK.

G. Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the Contract unit and/or lump sum prices in the Bidding Schedule.

1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the Drawings and Specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the Drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth, or other material displaced into uncleared areas shall be removed.

A. Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this Contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where

construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

B. Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

C. Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils.

D. Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

1. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.

E. Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the Drawings or as directed by the Architect/Engineer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve.

1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with the state's rules and all federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility.

A. Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

B. Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

C. Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise.

1.5 WASTE DISPOSAL

Disposal of wastes shall be as specified in Section 02220: EXCAVATING, BACKFILLING AND COMPACTING and as specified below.

A. Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off City property and dispose of it in compliance with federal, state, and local requirements for solid waste disposal.

B. Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. Chemical waste shall be collected in corrosion resistant, compatible containers. Wastes shall be disposed of in accordance with Federal and local laws and regulations.

C. Hazardous Wastes

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off City property and dispose of it in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Architect/Engineer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

D. Burning

Burning will not be allowed on construction site.

1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Architect/Engineer.

1.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

1.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization

with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

END OF SECTION

SECTION 01630 - SUBSTITUTIONS

PART 1 - GENERAL

1.01 GENERAL: General Conditions of the Contract, Supplementary Conditions, pertinent portions of sections in Division 1 of the Project Specifications and the Drawings shall apply to the Work of this Section

1.02 SUBSTITUTIONS:

A. Product List: Within 30 days after Contract Date, submit to the Architect a complete list of major products proposed to be used, with name of manufacturer and installing contractor.

B. Contractor's Option:

1. For products or methods specified only by commercial standard, reference standard, Federal Specification, trade association standards or other similar standards; select any product or method meeting that standard. Where this specification requires a better quality than such standard, these project specifications shall govern.

2. For products specified by naming several products or manufacturers, select any one of products or manufacturers named, which complies with this project specification.

3. For products specified by naming one or more products, methods or manufacturers and "or equal", Contractor must submit a request as for substitutions for any product or method or manufacturer not specifically named.

4. For products specified by naming only one product, method or manufacturer, and "no substitutions"; provide specified product, methods or manufacturer.

NOTE: Where proprietary products or methods are specified for one use, the intention is to establish a standard of quality, performance and/or size and not to exclude any other products of equal merit unless stated otherwise.

1.03 SUBSTITUTIONS: For products specified as above, bids shall be based on products named in Project Manual, or on items which Architect has designated as an "approved equal". A product not named in Project Manual or that is not approved by Architect

will only be acceptable when such product meets all other requirements of Project Specifications, including specifications of originally specified products' manufacturer as of date of contract documents.

1.04 REQUESTS FOR SUBSTITUTIONS: Requests for Architects approval of a product as equal will not be considered unless sufficient data for evaluation is received by Architect.

1.05 SUBMITTALS: Submit a separate request for each product, supported with complete data, with drawings, cut sheets, and samples as appropriate, including:

A. Comparison of qualities of proposed substitution with that of specified product.

B. Changes required in other elements of the Work because of substitution.

C. Effect on construction schedule.

D. Cost data comparing proposed substitution with product specified.

E. Availability of maintenance service, and source of replacement parts.

1.06 CONTRACTOR'S REPRESENTATION: Contractor's substitution of a product constitutes a representation that Contractor:

A. Has investigated proposed product and determined that it is equal or superior in all respects to that specified.

B. Will provide same warranties or bonds for substitutions as for product specified.

C. Will coordinate installation of an accepted substitution into Work, and make such other changes as may be required to make Work complete in all respects.

D. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

1.07 APPROVAL: Architect shall be judge of acceptability of proposed substitutions. Architect will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of decision to accept or reject requested substitution.

1.08 NOTICE: Architect's approval of an item for a previous project does not constitute approval for this Project.

PART 2 - PRODUCTS NOT APPLICABLE

PART 3 - EXECUTION NOT APPLICABLE

END OF SECTION

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SCOPE: Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedure in closing out the Work.

1.02 WORK SPECIFIED IN OTHER SECTION:

A. Cleaning: Section 01710

B. Project Record Documents: Section 01720

C. Operating and Maintenance Data: Section 01730

D. Warranties and Bonds: Section 01740

1.03 SUBSTANTIAL COMPLETION:

A. When Contractor considers the Work is substantially complete, he shall submit to Architect, written notice that the Work, or designated portion thereof, is substantially complete including list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, Architect will make an inspection to determine the status of completion.

C. Should Architect determine that the Work is not substantially complete:

1. Architect will promptly notify the Contractor in writing, giving the reasons therefore including list of items to be completed or corrected.

2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.

3. Architect will re-inspect the Work.

D. When Architect concurs that the Work is substantially complete, he will:

1. Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.

2. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

1.04 FINAL INSPECTION:

A. When Contractor considers the Work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.

5. Work is completed and ready for final inspection.

B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the Work is incomplete or defective:

1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete.

3. Architect will re-inspect the Work.

D. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 RE-INSPECTION FEES:

A. Should Architect perform re-inspection due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Owner will compensate Architect for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS:

A. Evidence of compliance with requirements of governing authorities:

1. Certificate of Occupancy.

2. Certificates of Inspection:

a. Mechanical
b. Electrical

B. Project Record Documents: To requirements of Section 01720.

C. Operating and Maintenance Data, Instructions to Owner's Personnel: To requirements of Section 01730.

D. Warranties and Bonds: To requirements of Section 01740.

E. Keys and Keying Schedule: To requirements of Section 08710.

F. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

1.07 FINAL ADJUSTMENTS OF ACCOUNTS:

A. Submit a final statement of accounting to Architect. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders.
b. Allowances.
c. Unit Prices
d. Deductions for uncorrected Work.
e. Deductions for reinspection payments.
f. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

B. Architect will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.08 FINAL APPLICATION FOR PAYMENT:

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION: Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 DISPOSAL REQUIREMENTS: Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION:

A. Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations or his subcontractor's operations. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.

B. At reasonable intervals during progress of work, clean up site, building and access, and dispose of waste materials, rubbish and debris. Provide containers and locate on site for collection of waste materials, rubbish and debris. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.

C. Transport waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces. Sprinkle dusty debris with water.

D. Burning or burying of rubbish and waste materials on the project site is not permitted. Disposal of volatile fluid wastes (such as mineral spirits, oil, or paint thinner) in storm or sanitary sewer systems is not permitted. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.

3.02 DUST CONTROL:

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

C. Broom clean interior building areas when ready to receive finish painting and continue cleaning on an as needed basis until building is ready for acceptance or occupancy.

3.03 FINAL CLEANING:

A. At completion of construction and just prior to acceptance or occupancy conduct a final inspection of exposed interior and exterior surfaces. Perform final cleaning and maintain cleaning until building, or portion thereof, is accepted by Owner.

B. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from interior and exterior surfaces. Repair, patch and touch-up marred surfaces to match adjacent finishes. Broom clean paved surfaces; rake clean other surfaces of grounds.

C. Clean all glass and all other finish surfaces, replace all broken and scratched glass; remove stains, spots, marks and dirt from decorated work; clean all hard-ware; remove paint spots and smears from all surfaces, clean all fixtures and wash or vacuum all floors; leaving work in a clean and spotless condition.

D. Replace air conditioning filters if units were operated during construction. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction.

E. Remove all waste materials and rubbish from and about the Project as well as all tools, construction equipment, machinery and surplus cleaning.

F. Use experienced workmen or professional cleaners for final cleaning.

G. Comply with cleaning instructions contained in the Specifications. In absence of specific cleaning instructions, follow accepted cleaning practices or the recommendations of the manufacturer of the material to be cleaned.

END OF SECTION

SECTION 01720 - PROJECT RECORD DOCUMENTS

1.01 GENERAL:

A. Maintain at the Site for the Owner one record copy of:

1. Drawings and Specifications

2. Addenda

3. Change Orders and other Modifications to the Contract

4. Architect/Engineer Field Orders or written instructions.

5. Approved Shop Drawings, Product Data and Samples.

6. Field Test records.

B. The Contractor will provide one set of Construction Drawings at the time construction is commenced. These drawings shall be marked up by Contractor, throughout the construction period, indicating all changes, revisions and additions to the Work, including field relocations of work concealed from view.

1.02 RECORD DRAWINGS: In accordance with the requirements of the General Conditions, the Architect will provide the Contractor with a set of reproducible drawings of the original bidding documents, as required and at Contractor's expense as follows:

A. If the Contractor elects to vary from the Contract Documents, and secures prior approval of the Architect, for any phase of the Work other than those listed below, he shall record in a neat readable manner all such variances on the reproducible drawings furnished.

B. For plumbing, heating, ventilating and air conditioning, electrical, and fire protection work; Record Drawings shall be maintained by the Contractor as this work progresses and as follows:

1. All deviations from sizes, locations and from all other features of all installations shown in the Contract Documents shall be recorded.

2. In addition, it shall be possible, using these Drawings, to correctly and easily locate, identify and establish sizes of all piping, directions and the

like, as well as all other features of work which will be concealed underground and/or in the finished building.

a. Locations of underground work shall be established by dimensions to column lines or walls, locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.

b. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases, this may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actual installed. Architect's decisions shall be final.

C. The following requirements apply to all Record Drawings:

1. They shall be maintained at the Contractor's expense.

2. All such drawings shall be done carefully and neatly by a competent draftsman and in form approved by the Architect.

3. Additional drawings shall be provided as necessary for clarification.

4. They shall be kept up-to-date during the entire course of the Work and shall be available on request for examination by the Architect and, when necessary, to establish clearances for other parts of the work.

5. The Record Drawings shall be returned to the Architect on completion of the Work and are subject to the approval of the Architect.

END OF SECTION

SECTION 01730 - OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 GENERAL:

A. Compile Manufacturer's Directions and Manuals, Product Data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

1. Furnish operating and maintenance data as specified in other pertinent sections of Specifications.

B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.02 FORM OF SUBMITTALS:

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Bind in Commercial quality three ring binders with durable and cleanable plastic cover, with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".

C. When multiple binders are used, correlate the data into related consistent groupings.

1.03 CONTENT OF MANUAL:

A. Neatly typewritten table of contents for each volume, arranged in a systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to the content of the volume.

3. List, with each product, the name, address and telephone number of:

a. Subcontractor or installer.

b. Maintenance contractor, as appropriate.

c. Identify the area of responsibility of each.

d. Source of supply for parts and replacement.

4. Identify each product-by-product name and other identifying symbols.

B. Product Data: Include only those sheets which are pertinent to the specific product. Clearly identify the specific product or part installed.

C. Drawings: Supplement product data with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.

1. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

2. Do not use Project Record Documents as maintenance drawings.

D. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.

2. Instances which might affect the validity of warranties or bonds.

1.04 MANUAL FOR MATERIALS AND FINISHES:

A. Submit two copies of complete manual in final form.

B. Content, for architectural products, applied materials and finishes:

1. Manufacturer's data, giving full information on products.

2. Instructions for care and maintenance.

1.05 MANUAL FOR EQUIPMENT AND SYSTEMS:

A. Submit copies of complete manuals for mechanical and electrical equipment as required by Specifications.

1.06 SUBMITTAL SCHEDULE:

A. Submit one copy of completed data in final form fifteen days prior to final inspection or acceptance.

1. Copy will be returned after final inspection or acceptance, with comments.

B. Submit specified number of copies of approved data in final form 10 days after final inspection or acceptance.

1.07 INSTRUCTION OF OWNER'S PERSONNEL:

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

C. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

END OF SECTION

SECTION 01740 -WARRANTIES AND BONDS

1.01 SUBMITTAL REQUIREMENTS:

A. Assemble warranties, bonds and services and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Review submittals to verify compliance with Contract Documents. Submit to Architect for review and transmittal to Owner.

1.02 TIME OF SUBMITTALS:

A. For equipment or component parts of equipment put into service during progress of construction submit within 10 days after inspection and acceptance.

B. Otherwise make submittals within ten days after Date of Substantial Completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.

END OF SECTION

SECTION 01750
Release of Lien Form

Contractor name: _____

Address: _____

Contract name/number: _____

Project location: _____

Contract execution date: _____

I, the undersigned, confirm that I was contracted to construct, alter or repair improvements on the above-referenced project.

All improvements on the subject properties have been fully and satisfactorily completed in substantial conformity with the contract. All materials used in said improvement, all labor performed thereon and all fees, industrial insurance and permits, in connection with the said improvements which might give rise to liens on the within described properties have been paid in full.

Listed below are all subcontractors and major material suppliers included in this work. Attached are waivers of liens from all of them as substantiation of the above statement.

Name of Subcontractor(s) or Supplier(s) and Addresses

_____

_____

_____

The affront hereby waives any lien or right to lien which he may have against the described property and warrants to save harmless the Owner from any liens which are now in existence, or may hereafter arise by reason of said improvements, and cause the same to be released of record immediately. The foregoing waiver and these statements are an express warranty and representation to the Owner of the facts whereof is acknowledged.

_____ _____

Date **Contractor**

SUBSCRIBED and SWORN to before me on _____

Date

_____

Notary Public

My commission expires: _____

SECTION 02010
SUBSURFACE CONDITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. General
A soils investigation report has been prepared for the site of this work by Materials Testing of Arkansas, Inc., hereinafter referred to as the Soil Engineer.

B. Availability
The soils investigation report is included in these specifications.

C. Use of Data

1. This report was obtained only for the Architect's/Engineer's use in design and is not a part of the Contract Documents. The report is available for bidder's information, but is not a warranty of subsurface conditions.

2. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the Engineer/Architect.

3. Bidders shall acquaint themselves with the soils investigation pertaining to the types of soil conditions found at this site.

1.3 QUALITY ASSURANCE

A. Adjustment of Work
Readjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Documents without specific and written approval from the Architect/Engineer.

END OF SECTION

MTA Engineers: *a Division of Materials Testing of Arkansas, Inc.*
•Little Rock, AR •Springdale, AR •Jonesboro, AR
P.O. Box 23715 Little Rock, AR 72221
501-753-2526 or mtaengineers.com

REPORT OF GEOTECHNICAL EXPLORATION
FORREST CITY, CITY HALL

PREPARED FOR:

ETC ENGINEERS & ARCHITECTS, INC.
1510 SOUTH BROADWAY
LITTLE ROCK, ARKANSAS 72202

PREPARED BY:

KELTON PRICE, P.E.
PROJECT ENGINEER
MATERIALS TESTING OF ARKANSAS, INC.
MTA ENGINEERS

DATE
September 14, 2016

TABLE OF CONTENTS

APPENDICES

TABLES

EXECUTIVE SUMMARY:

The exploration of the proposed Forrest City, City Hall was conducted south west of the intersection Garland Avenue and North Washington Street in Forrest City, Arkansas.

The general topography of the site was uniformly sloping. The site was covered with four (4") inches of concrete and three (3") inches of asphalt. Subsurface conditions remained relatively consistent throughout the entirety of the proposed development. Major soil types encountered at each boring may be summarized as follows:

Table 1. Soil Types Encountered at the Existing Substation Site

SOIL TYPE	DESCRIPTION
CL-ML	Lean Silty Clay

See Table 2 General Strata Classification of Boring Logs or the individual boring logs found in Appendix B for a more detailed overview of the soils encountered on site. No water table was encountered at the proposed City Hall; however, some material appeared to be saturated near the bottom of the borings.

Based on the nature of the existing soil encountered at the time of exploration it is recommended that any small structures be supported on continuous and/or individual spread footings founded a minimum of twenty-four (24) inches beneath final exterior grade. All shallow footings should be founded within the tan/gray lean silty clay or structural fill.

Shallow foundations founded within the tan/gray lean silty clay at a depth of four (4') feet may be sized using a net allowable end bearing of 1500 and 2000 pounds per square foot (psf) for continuous and individual spread footings, respectively. Shallow foundations founded a minimum of two (2') feet within properly compacted structural fill may be sized using a net allowable end bearing pressure of 2000 and 2500 pounds per square foot (psf) for continuous and individual spread footings, respectively. This net allowable end bearing pressure is based on a factor of safety in excess of three (3.0) with respect to the anticipated shear strength of footing material.

It is estimated that during demolition of the existing slab and foundation, three (3') feet of material will be removed from the site. Due to this estimation, and additional undercut of one (1') foot under the building pad is recommended prior to placement of fill. The parking area should be undercut up to two (2') feet and replaced with approved select fill. It is recommended that a representative of Materials Testing of Arkansas be present during placement of all compacted fill.

INTRODUCTION:

This exploration was requested in order to evaluate existing subsurface conditions and also provide geotechnical design recommendations. The results of this exploration and the preliminary geotechnical design recommendations for site construction are presented in this report.

Exploration was accomplished by:

1.) Performing borings at four (4) locations to a maximum depth of twenty (20') feet to explore subsurface soil, rock, and groundwater conditions.
2.) Obtaining samples from each stratum at the four (4) testing locations.
3.) Performing laboratory tests on various samples to determine pertinent engineering properties of the subsurface strata.
4.) Analyzing field and laboratory test data to develop design recommendations.

The scope of this geotechnical exploration did not include an environmental assessment for determining the presence of wetlands and/or hazardous or toxic materials in the soil or groundwater on or near this site. If there is concern of wetlands or a hazardous/toxic material presence, a qualified environmental assessment consultant should be contacted to perform a site investigation before construction begins.

FIELD EXPLORATION:

Subsurface conditions at the site were explored by using dry auger methods and split-spoon sampling to a depth of twenty (20) feet at four boring locations within the areas of the former building and parking. The approximate boring locations are shown on the Plan of Borings, Appendix A. Boring Log Reports presenting descriptions of the soil strata encountered and results of field and laboratory tests are included in Appendix B. A key to the terms and symbols used on the Boring Log Reports is presented in Appendix C.

Samples were obtained throughout the entirety of each location in general accordance with Standard Penetration Sampling (N-Value). The recorded N-Values (Blows per foot) are indicated on the Boring Logs in the Blows per foot column. All soil samples encountered were removed from the field in moisture tight containers and transported to our laboratory for further examination. At the lab a visual classification was performed for each sample. All various soil types were then analyzed for specific engineering properties.

The dry auger drilling procedures facilitated observation of shallow groundwater conditions. Observations regarding groundwater are noted in the lower right portion of each log and are discussed in subsequent sections of this report.

GENERAL SITE AND SUBSURFACE CONDITIONS:

The exploration of the proposed Forrest City, City Hall was conducted south west of the intersection Garland Avenue and North Washington Street in Forrest City, Arkansas. The general topography of the site was uniformly sloping. The site was covered with four (4") inches of concrete and three (3") inches of asphalt. Initially, it is assumed that the structure will be placed at or near the existing grade. The stratigraphy encountered in the boring locations is summarized in Table 2. For a more

detailed description of soils encountered while testing see the boring log sheets found in Appendix B.

Table 2. General Strata Classification of Boring Logs

STRATA	DEPTH	SOIL CLASSIFICATION	SOIL DESCRIPTION	SIGNIFICANT PROPERTIES
STRATUM I	0 – 4"	Concrete/Asphalt		
STRATUM II	4" – 20'	CL-ML	Soft to Stiff Tan/Gray Silty Clay	Moisture Sensitive

No significant groundwater was encountered at the existing substation location. Saturated soils were encountered at approximately 19'. The significant properties and characteristics of the subsurface strata pertinent to design and construction are:

A. The topography of the site and planned locations.
B. The soft to stiff silty clay of Stratum II.
C. The material being moisture sensitive.

The relationship of these factors to design and construction of the proposed facility is considered in the subsequent sections of this report.

LABORATORY TESTING:

Descriptions of the soils encountered in the sample locations will be prepared in general accordance with applicable ASTM standards. The soil stratification shown on the Boring Log Reports represent soil conditions at the specific sample locations. Possible variations occur between or beyond the sample location. The stratification lines on the Boring Log represent the approximate boundaries between soil types, but actual transitions between soil layers in the stratification of the proposed site may be gradual.

Laboratory testing was performed to verify/evaluate classification, volumetric stability, shear strength and to determine water content. The results of all testing performed are presented on the Boring Logs and attached as Appendix D.

ANALYSIS AND RECOMMENDATIONS:

SITE PREPARATION:

It is assumed that the demolition of the existing slab and foundation will remove three feet of material below the bottom of the slab. It is recommended that an additional one (1') foot of undercut be performed under the building. After undercutting, the in-situ soils should be scarified and re-compacted to a minimum of 98% of the standard proctor (ASTM D-698). Approved fill should then be placed according to the "Structural Fill" section of this report.

Excavation should be performed under dry conditions, using equipment adequate to perform the work. Medium to heavy construction equipment should be adequate to perform work needed. Positive drainage should be maintained throughout this process. The addition of excessive moisture could cause a significant loss of soil stability. Depending upon time of construction additional

isolated undercutting may be needed for areas of high moisture content where loss of soil shear strength has occurred due to inundation. Construction roads and drives will require continuous maintenance to provide access to the site. Additional efforts may be required in the areas of construction drives to aide in the construction of the site.

STRUCTURAL FILL:

Fill should consist of approved materials, which are free of organic matter and debris. For approval, samples of the proposed fill material should be submitted to Materials Testing of Arkansas for classification testing. Select fill consisting of low plasticity (lean clay) soil or clayey gravel classifying as SC, CL, or GC according to the Unified Soils Classification System are generally considered suitable. High plasticity clay soils or soils with a Liquid Limit above fifty (50) should not be used. Rock fragments that are greater than 4 inches in any dimension should not be included in engineered fill in the building area. In the parking area or drive areas, a maximum rock fragment of 6 inches may be used in depths greater than 4 feet of the engineered fill. The upper 4 feet of the parking and drive areas should follow the 4 inches or smaller rock size fragments.

Placement of approved fill should be achieved in multiple thin lifts. Each lift should not exceed 8" loose thickness. Compaction of these lifts should be performed with suitable equipment to achieve 95% of modified proctor (ASTM D1557) at two (2%) percent below to three (3%) percent above optimum moisture content. Thinner lifts may be required based on the compaction equipment being used. Care should be taken that all compaction recommendations are performed.

If cohesive soils are to be used, compaction should be performed using a kneading-type vibratory compactor such as a vibratory sheepsfoot. The material should be broken down sufficiently to provide a dense matrix of particles.

BUILDING FOUNDATIONS:

All foundations must satisfy two basic and independent design criteria. First, foundations must have an acceptable factor of safety against bearing failure under maximum design loads. Secondly, movement of the foundation due to consolidation, shrinkage, and/or swelling of the supporting strata should not exceed tolerable limits for the structure. Construction factors such as installation of foundations units, excavation procedures, and surface and groundwater conditions should also be considered. The factors and the aforementioned subsurface conditions were influential in development of the following recommendation.

In view of the anticipated foundation loading and subsurface conditions encountered, it is recommended that the proposed structures be supported on a foundation system designed in accordance with the following recommendations.

SHALLOW FOUNDATIONS:

It is recommended that the proposed lightweight structures be supported within properly compacted select fill. Foundations founded as recommended, may be founded a minimum of twenty-four (24") inches beneath final exterior grade. Footings founded in select fill, may be sized using a net allowable end bearing pressure of two thousand and twenty-five hundred (2000 – 2500 psf) pounds per square foot for continuous and individual spread footings, respectfully. In addition, to minimize the potential for localized shear failure within the soils, a minimum footing width of twenty-four (24") inches is recommended.

If the proposed building is founded in the stiff silty clay of Stratum II, the foundation may be sized using a net allowable end bearing pressure of fifteen hundred and two thousand (1500 – 2000 psf) pounds per square foot, for continuous and individual spread footings, respectively. If soft soils due to saturation are encountered, undercut of the soils and backfilled with approved fill may be required. This net allowable end bearing pressure is based on a factor of safety in excess of three (3.0) with respect to the measured shear strength.

SEISMIC CONSIDERATIONS:

Based on IBC Table 1615.1.1, a site soil class D may be used for design purpose. Liquefaction potential of the soils in Stratum II is low.

PAVEMENT DESIGN:

Paved roadways may be constructed as part of the project. Design traffic volumes and loadings have not been determined at this time; however, we anticipate that the drives will be subject to light vehicles and weekly service trucks. Roadways will be used primarily by automobiles. We also anticipate that pavement construction will involve only minor cut and fill. The following design criteria were used to develop the recommended pavement sections in conjunction with the AASHTO Design Guide 1996:

Table 3. Pavement Design Assumption Values

PAVEMENT DESIGN ASSUMPTION VALUES	
CBR	5
R-VALUE	15
SOIL SUPPORT VALUE (S)	5

Based on information obtained during this study, subgrade soils in the paved areas should generally consist of the soils in Stratum II or structural fill.
Structural fill, where required, should be placed as recommended in the site grading section of the report. It is recommended that positive site drainage should be provided during construction and be incorporated during the final design.

Table 4. Pavement Design Recommendations

PAVEMENT DESIGN RECOMMENDATIONS	
Light Duty Asphalt Paving	3" Asphalt Surface Course
	8" Crushed Stone Base Course
	12" Compacted Subgrade (Min. CBR 5)
Heavy Duty Asphalt Paving	4" Asphalt Surface Course
	8" Crushed Stone Base Course
	12" Compacted Subgrade (Min. CBR 5)
Concrete Paving	5" Concrete Pavement
	8" Crushed Stone Base Course
	24" Compacted Subgrade (Min. CBR 5)
Dumpster Pad if needed	6" Concrete Pavement
	8" Crushed Stone Base Course
	24" Compacted Subgrade (Min. CBR 5)

It should be recognized that some periodic maintenance of pavement will be required. As a minimum, this should include periodic sealing of all joints and cracks to prevent surface water infiltration.

CONSTRUCTION PROCEDURES:

The potential exists for increased groundwater to develop during wetter seasons. Therefore, foundation excavation and any other site grading should be performed during drier periods to reduce the possibility of changes in conditions.

Subsurface conditions significantly at variance with those encountered within the borings should be brought to the attention of the engineer, and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

* * * * *

The following illustrations are attached and complete this report:

Appendix A Plan of Borings
Appendix B Boring Logs
Appendix C Key to Terms and Symbols
Appendix D Laboratory Testing Results

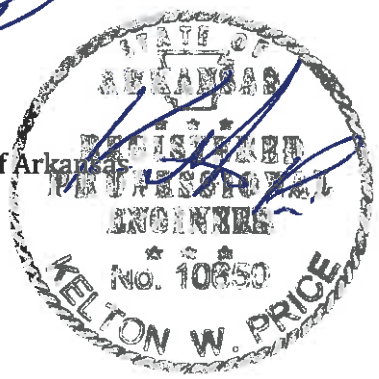
* * * * *

The opportunity to be of service on this project is highly appreciated. If there are any questions regarding information provided in this report, or if additional assistance during final design or construction is required, please contact us. Final grades have not provided at the time of this report. Requirements for retaining walls will be added, if required.

Sincerely,

Materials Testing of Arkansas, Inc.
MTA Engineers

Kelton Price, P.E.
Project Engineer
Materials Testing of Arkansas
MTA Engineers



Appendix A

Approximate Boring Locations

Appendix B

MTA ENGINEERS a division of MATERIALS TESTING OF ARKANSAS
www.mtaengineers.com

Boring Log Report

BORING NO. B-1
PAGE 1 OF 1

JOB NO.
JOB NAME: FORREST CITY-CITY HALL
COORDINATES: NORTH: EAST:
STATION:
LOCATION: SEE APPENDIX

DATE: 8-25-16
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: SIMCO 2800
LOGGED BY: T. UEKMAN
DRILLED BY: L. JOHNSON

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION:	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-VALUE
										2 2-3	5
										1 1-1	2
5					NP	23.6	NV		86.7	6 5-8	13
			SOFT TO STIFF BROWN SILT GRADING TO TAN GRAY SILT	ML						4 6-7	13
										5 6-9	15
10											
					22	23.6	32	10	92.2	6 7-10	17
15			STIFF TAN GRAY LEAN CLAY	CL							
										4 3-3	6
20											
			Boring Terminated								
25											
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 19 AFTER 24 HOURS:

REMARKS:

P.O. Box 23715 • Little Rock, AR 72221
Ph. 501.753.2526 • Fax 501.753.5747

505 Sanders Ave. • Springdale, AR 72764
Ph. 479.756.0061 • Fax 479.756.9254

101 S. Church St. • Jonesboro, AR 72401
Ph. 870.530.8380 • Fax 870.972.0237

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MATERIALS TESTING OF ARKANSAS
www.mtaengineers.com

Boring Log Report

BORING NO. B-2
PAGE 1 OF 1

JOB NO.
JOB NAME: FORREST CITY-CITY HALL
COORDINATES: NORTH: EAST:
STATION:
LOCATION: SEE APPENDIX

DATE: 8-25-16
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: SIMCO 2800
LOGGED BY: T. UEKMAN
DRILLED BY: L. JOHNSON

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION:	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-VALUE
										2 1-2	3
5										2 3-6	9
										6 6-9	15
										4 6-6	12
10			SOFT TO STIFF TAN GRAY SILT	ML							
										5 5-4	9
15											
					25	33.4	36	11	95.3	2 3-3	6
20			Boring Terminated								
25											
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 4 AFTER 24 HOURS:

REMARKS:

P.O. Box 23715 • Little Rock, AR 72221
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Ph. 479.756.0061 • Fax 479.756.9254

101 S. Church St. • Jonesboro, AR 72401
Ph. 870.530.8380 • Fax 870.972.0237

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MATERIALS TESTING OF ARKANSAS
www.mtaengineers.com

Boring Log Report

BORING NO. B-3
PAGE 1 OF 1

JOB NO.
JOB NAME: FORREST CITY-CITY HALL
COORDINATES: NORTH: EAST:
STATION:
LOCATION: SEE APPENDIX

DATE: 8-25-16
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: SIMCO 2800
LOGGED BY: T. UEKMAN
DRILLED BY: L. JOHNSON

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION:	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-VALUE
			FIRM TO STIFF GRAY SILT	ML						5 5-4	9
					NP	27.1	NV		92.8	2 3-4	7
5			STIFF GRAY TAN LEAN CLAY WITH SAND		21	24.1	30	9	83.9	4 5-7	12
					20	24.8	33	13	89.5	5 5-6	11
10										4 6-8	14
			FIRM TO STIFF GRAY TAN LEAN CLAY	CL							
15										4 5-6	11
20										4 3-4	7
			Boring Terminated								
25											
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: AFTER 24 HOURS:
REMARKS:

P.O. Box 23715 • Little Rock, AR 72221
Ph. 501.753.2526 • Fax 501.753.5747

505 Sanders Ave. • Springdale, AR 72764
Ph. 479.756.0061 • Fax 479.756.9254

101 S. Church St. • Jonesboro, AR 72401
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Boring Log Report

BORING NO. B-4
PAGE 1 OF 1

JOB NO.
JOB NAME: FORREST CITY-CITY HALL
COORDINATES: NORTH: EAST:
STATION:
LOCATION: SEE APPENDIX

DATE: 8-25-16
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: SIMCO 2800
LOGGED BY: T. UEKMAN
DRILLED BY: L. JOHNSON

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION:	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-VALUE
			FIRM TO STIFF BROWN TAN CLAYEY SILT	ML						14 5-5	10
					22	26.0	29	7	80.4	2 3-3	6
5			FIRM TO STIFF TAN GRAY SILTY CLAY WITH SAND	CL-ML						3 4-4	8
										3 3-3	6
					22	27.6	33	11	81.2	2 3-4	7
10											
15			FIRM TAN GRAY LEAN CLAY WITH SAND	CL						6 8-11	19
20										3 4-11	15
25			Boring Terminated								
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 19.5 AFTER 24 HOURS:

REMARKS:

P.O. Box 23715 • Little Rock, AR 72221
Ph. 501.753.2526 ◦ Fax 501.753.5747

505 Sanders Ave. • Springdale, AR 72764
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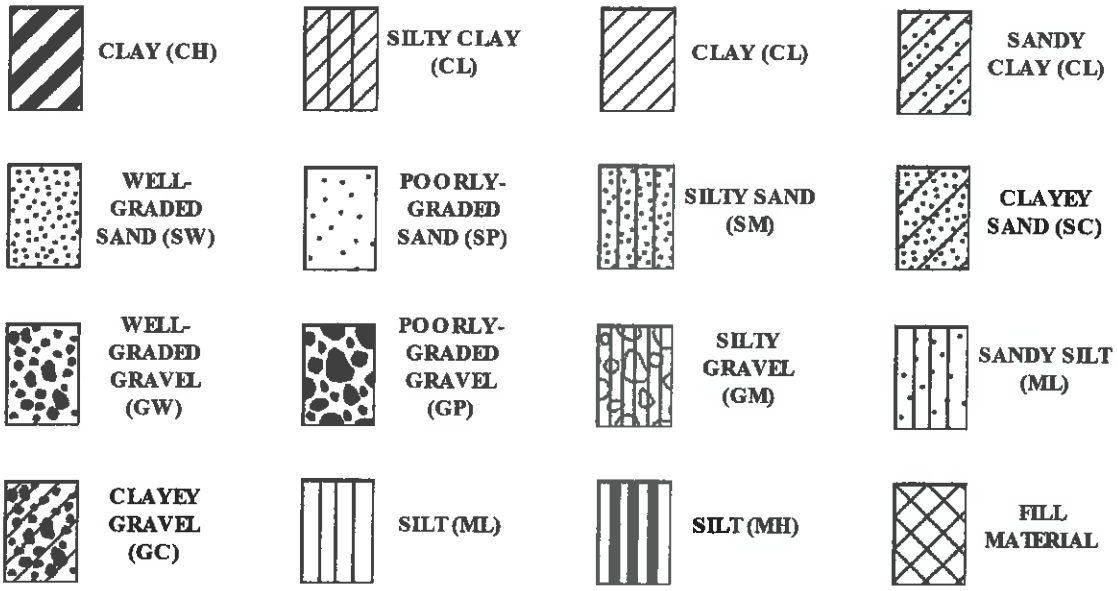
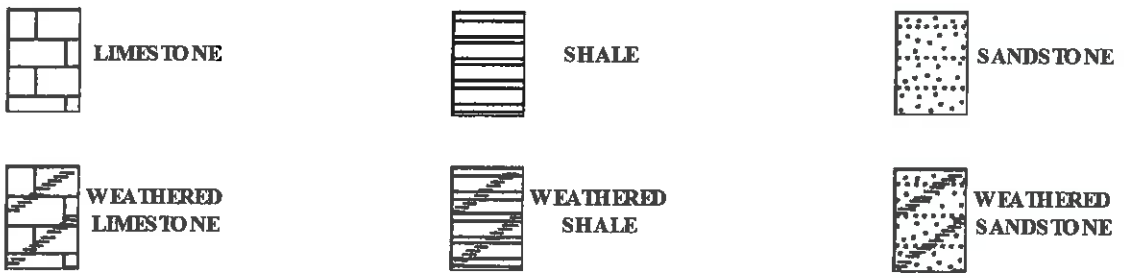
Appendix C

TERMS AND SYMBOLS USED ON BORING LOGS

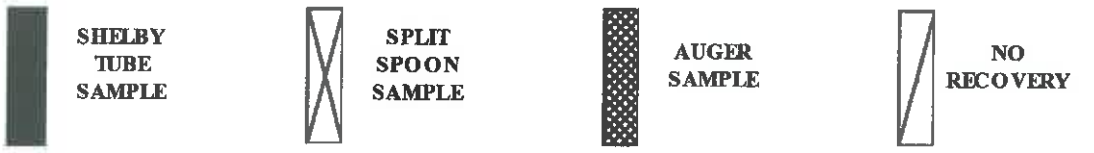
SOIL TYPES



ROCK TYPES



SAMPLER TYPE



SOIL GRAIN SIZE

U.S. STANDARD SIEVE								
12"	3"	3/4"	4	10	40	200		
BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		
304	76.2	19.1	4.75	2	0.42	0.074	0.002	
SOIL GRAIN SIZE IN MILIMETERS								

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No 200 sieve): Includes (1) clean gravels and sands, ~~and~~ (2) silty clayey gravels and sands condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERMS	N VALUE	RELATIVE DENSITY
VERY LOOSE	0-4	0 – 15 %
LOOSE	4-10	15 – 35 %
MEDIUM DENSE	10-30	35 – 65 %
DENSE	30-50	65 – 85 %
VERY DENSE	50 and above	85 – 100 %

FINE GRAINED SOILS (major portion passing No 200 sieve): include (1) inorganic and organic silt and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer reading or by unconfined compression tests.

DESCRIPTIVE TERMS	UNCONFINED COMPRESSIVE STRENGTH TON / SQ. FT.
VERY SOFT	less than 0.25
SOFT	0.25 - 0.50
FIRM	0.50 - 1.00
STIFF	1.00 - 2.00
VERY STIFF	2.00- 4.00
HARD	4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of planes of weakness or cracks in the soil. The consistency rating of such soils are based on penetrometer readings

TERMS CHARACTERIZING MOISTURE CONTENT

DRY: No water evident in sample; fines less than plastic limit.
MOIST: Sample feels damp; fines near the plastic limit.
VERY MOIST: Water visible on sample; fines greater than plastic limit and less than liquid limit.
WET: Sample bears free water; fines greater than liquid limit.

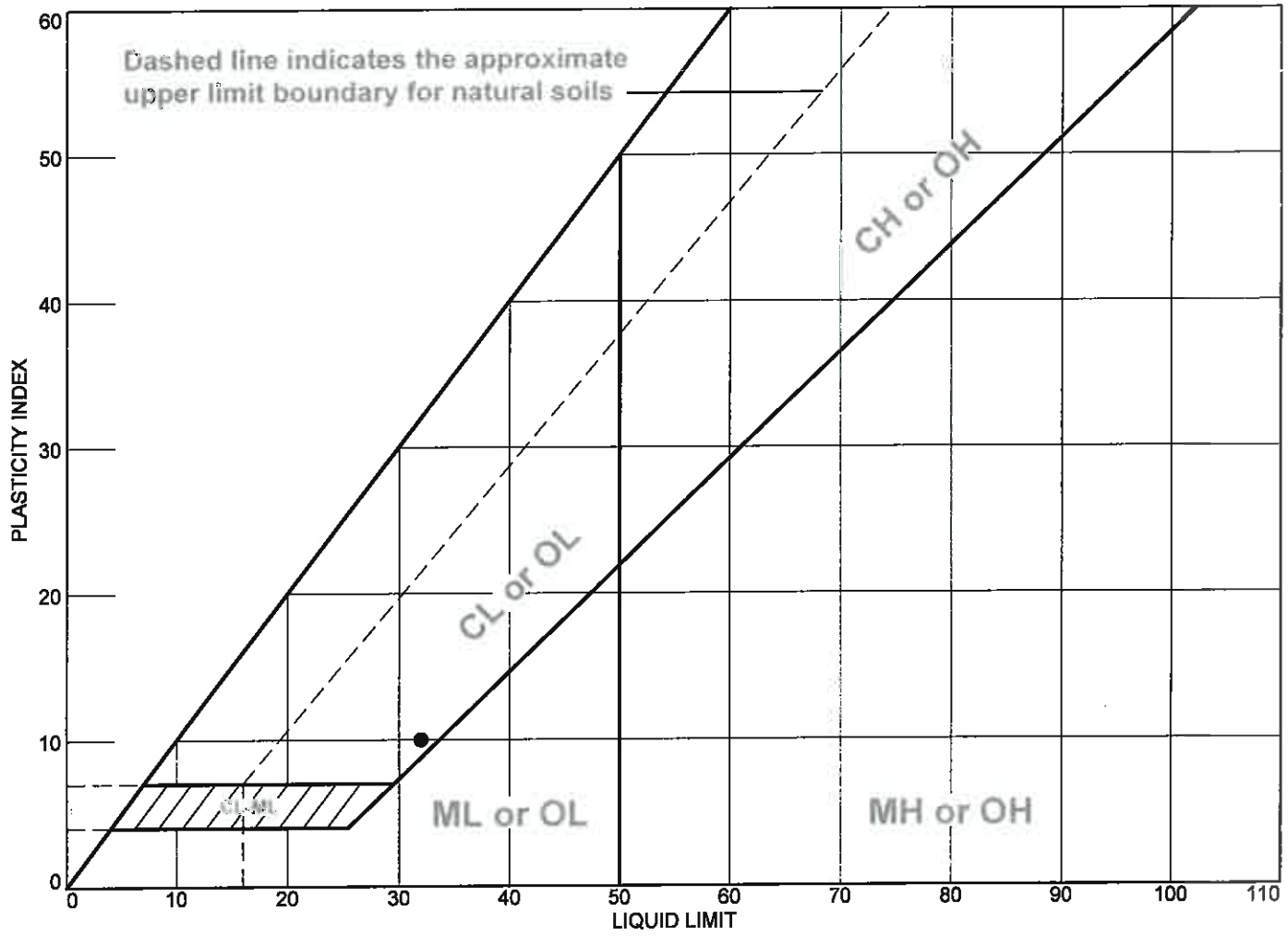
TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED: Having inclined planes of weakness that are slick and glassy in appearance.
FISSURED: Containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
LAMINATED: Composed of thin layer of varying color and texture.
INTERBEDDED: Composed of alternate layers of different soil types
CALCAREOUS: Containing appreciable quantities of calcium carbonate.
WELL GRADED: Having wide range in grain sizes and substantial amounts of all intermediate particle size.
POORLY GRADED: Predominantly of one grain size, or having a range of sizes with some intermediate size missing

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with UNIFIED SOIL CLASSIFICATION SYSTEM as described in technical Memorandum No 3-357, Waterways Experiment Station, March 1953

Appendix D

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	LEAN CLAY	32	22	10	96.2	92.2	CL
■	SILT	NV	NP	NP	91.2	86.7	ML

Project No. **Client:** ETC

Project: FORREST CITY-CITY HALL

● **Source of Sample:** B-1 **Depth:** 13.5

■ **Source of Sample:** B-1 **Depth:** 4

Remarks:

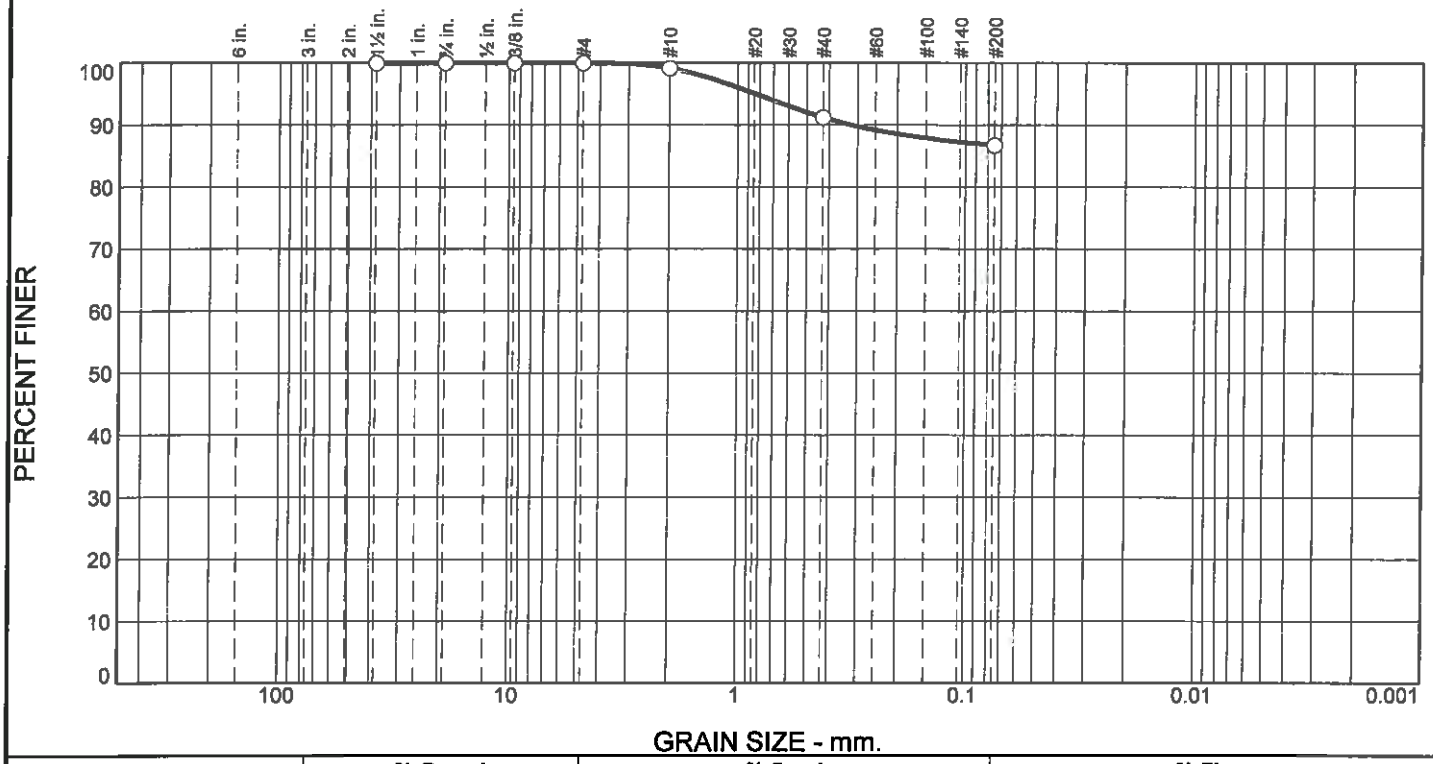
Materials Testing of Arkansas

Little Rock, AR

Figure

Tested By: T. UEKMAN

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.9	7.9	4.5	86.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.1		
# 40	91.2		
# 200	86.7		

* (no specification provided)

Material Description

SILT

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 0.3192 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

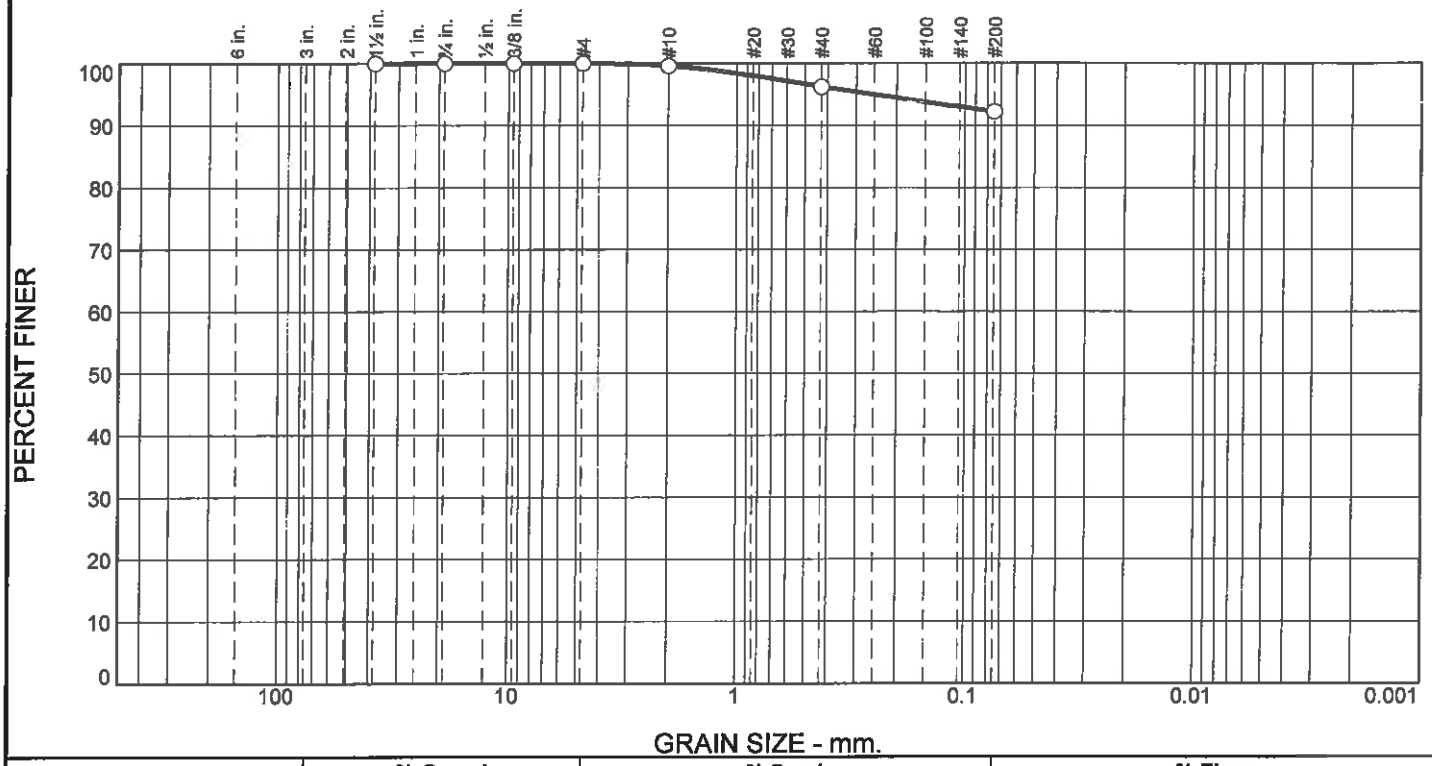
Checked By:

Title:

Source of Sample: B-1 **Depth:** 4 **Date Sampled:**

Materials Testing of Arkansas **Little Rock, AR**	**Client:** ETC **Project:** FORREST CITY-CITY HALL **Project No:** **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	3.4	4.0	92.2	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.6		
# 40	96.2		
# 200	92.2		

* (no specification provided)

Material Description

LEAN CLAY

Atterberg Limits (ASTM D 4318)

PL= 22 LL= 32 PI= 10

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-4(9)

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-1 **Depth:** 13.5 **Date Sampled:**

Materials Testing of Arkansas

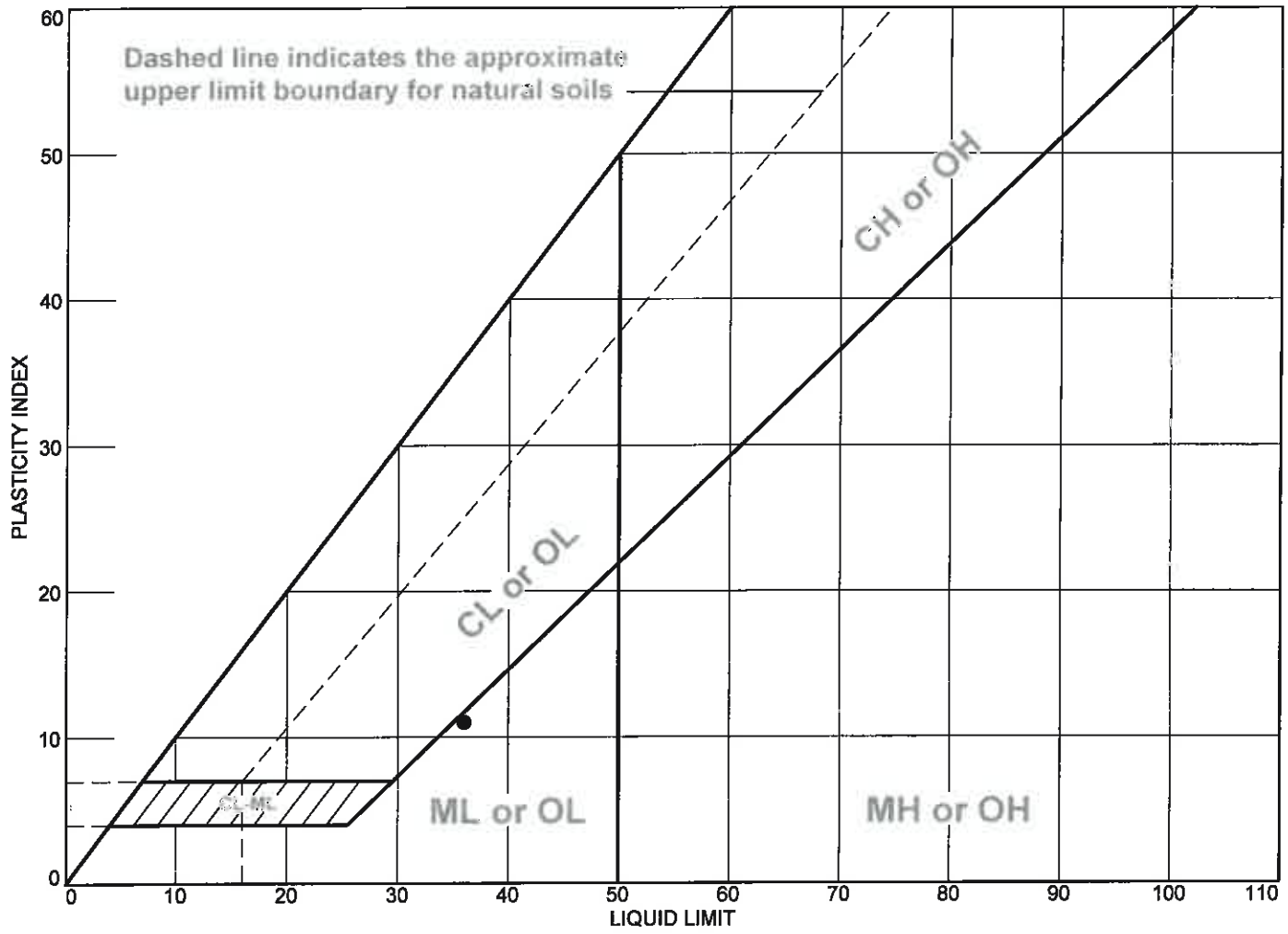
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILT	36	25	11	98.1	95.3	ML

Project No. **Client:** ETC

Project: FORREST CITY-CITY HALL

● **Source of Sample:** B-2 **Depth:** 18.5

Remarks:

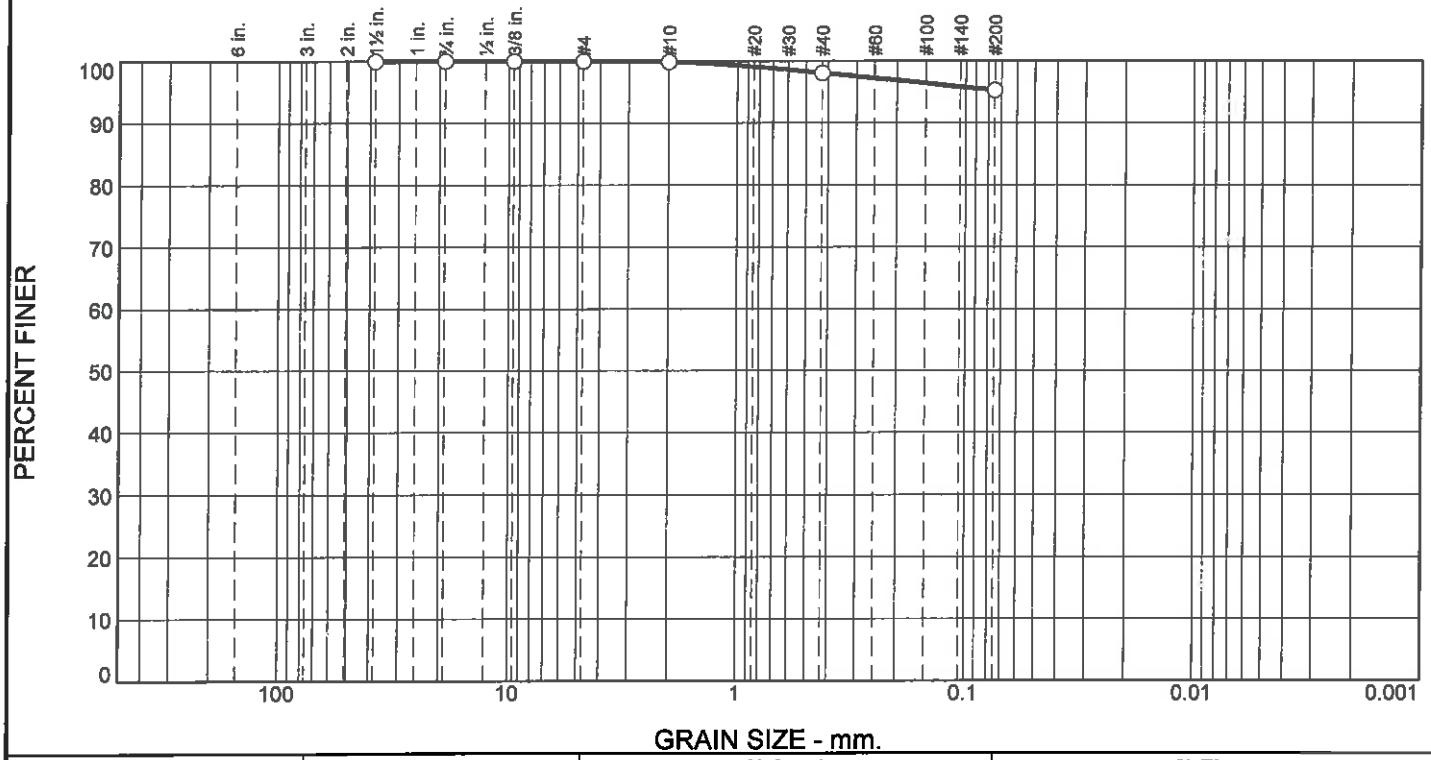
Materials Testing of Arkansas

Little Rock, AR

Figure

Tested By: T. UEKMAN

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.8	2.8	95.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.9		
# 40	98.1		
# 200	95.3		

* (no specification provided)

Material Description

SILT

Atterberg Limits (ASTM D 4318)

PL= 25 LL= 36 PI= 11

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-6(12)

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-2 **Depth:** 18.5 **Date Sampled:**

Materials Testing of Arkansas

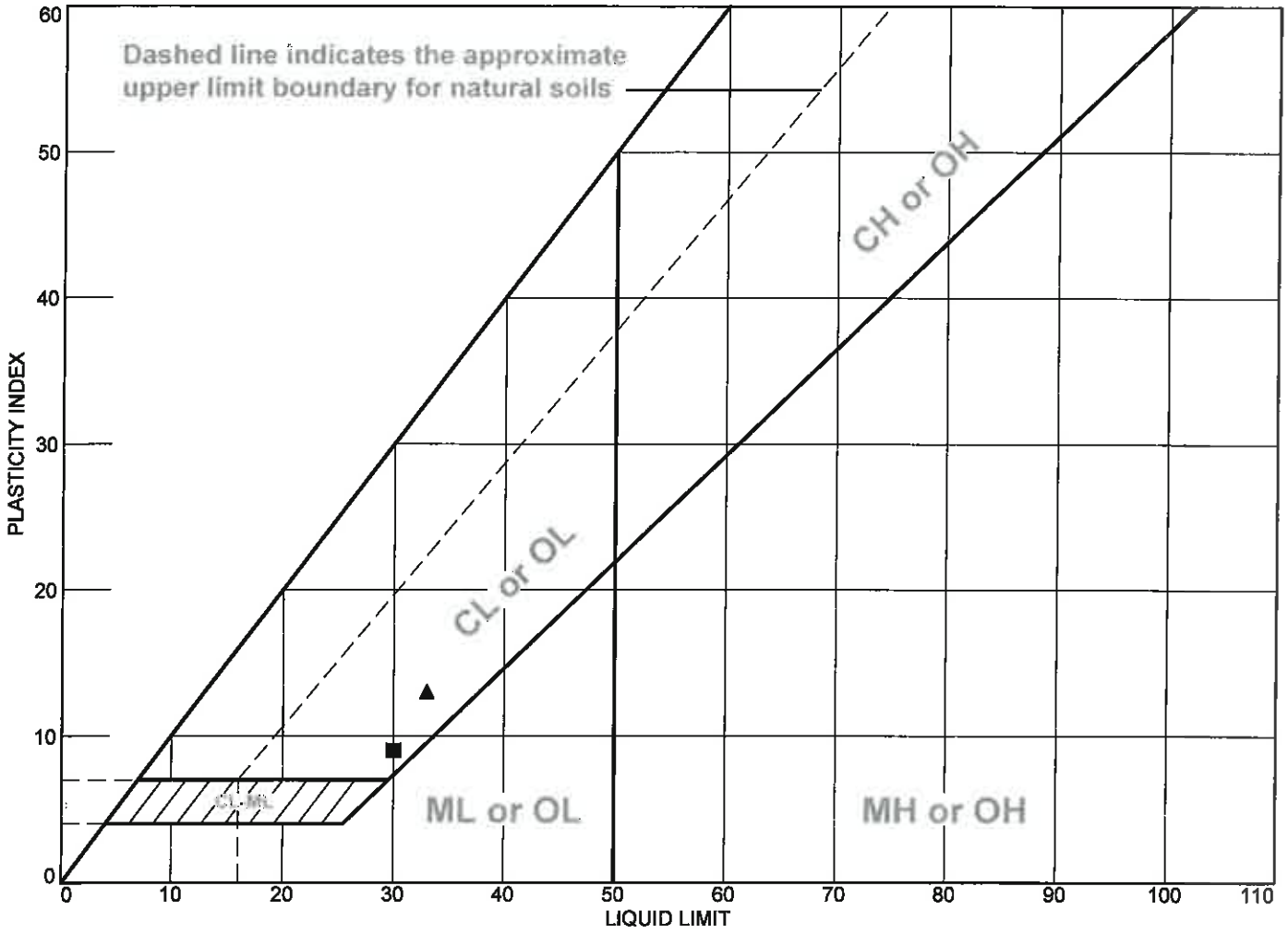
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILT	NV	NP	NP	97.6	92.8	ML
■	LEAN CLAY WITH SAND	30	21	9	91.9	83.9	CL
▲	LEAN CLAY	33	20	13	96.7	89.5	CL

Project No. **Client:** ETC

Project: FORREST CITY-CITY HALL

● **Source of Sample:** B-3 **Depth:** 2.5
■ **Source of Sample:** B-3 **Depth:** 4.5
▲ **Source of Sample:** B-3 **Depth:** 6.5

Remarks:

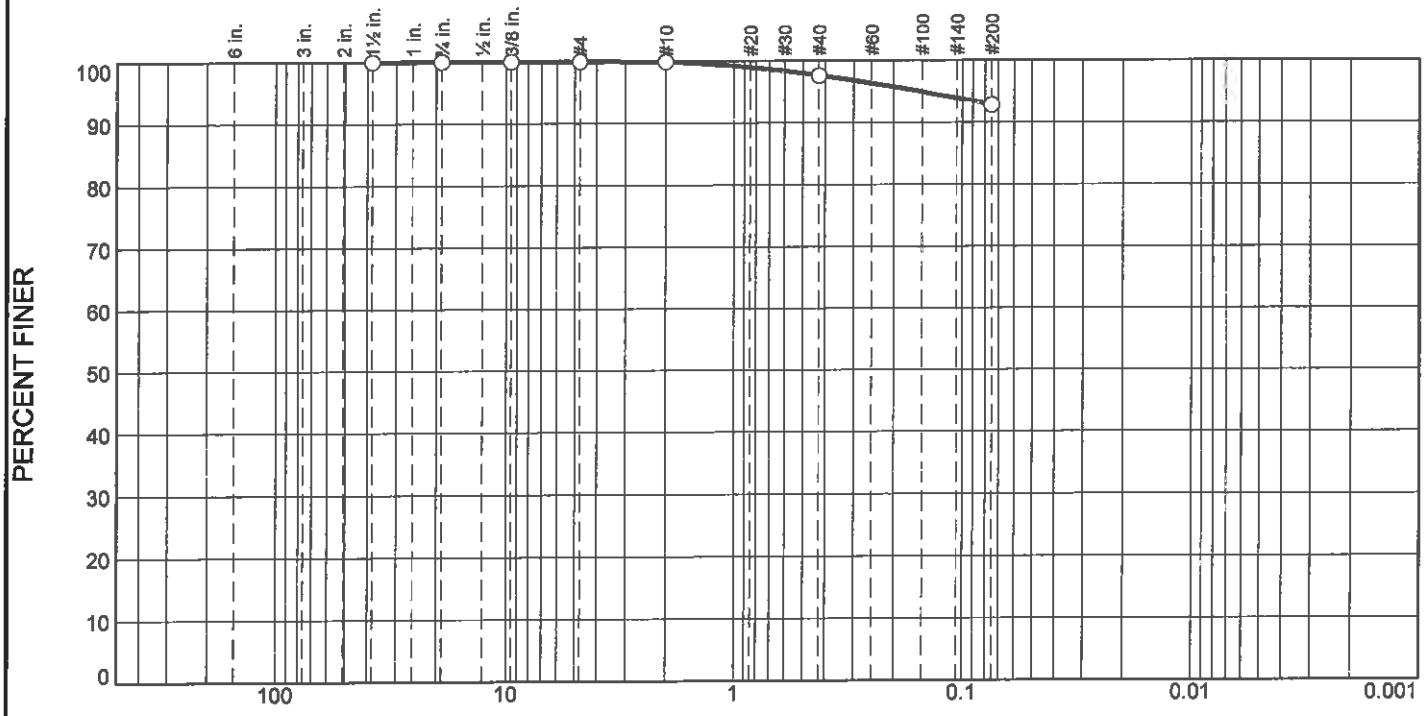
Materials Testing of Arkansas

Little Rock, AR

Figure

Tested By: T. UEKMAN

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	2.3	4.8	92.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.9		
# 40	97.6		
# 200	92.8		

* (no specification provided)

Material Description

SILT

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-3 **Depth:** 2.5 **Date Sampled:**

Materials Testing of Arkansas

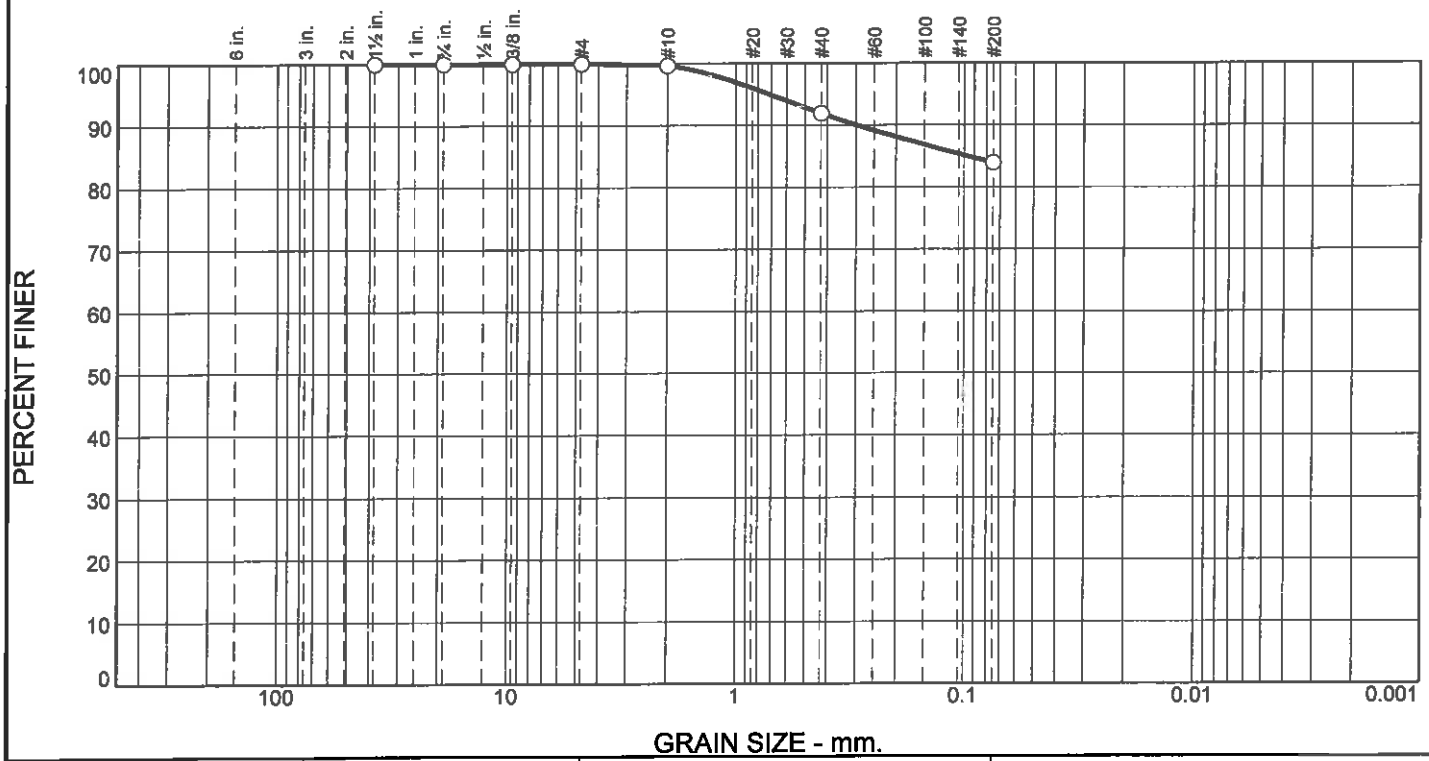
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	7.8	8.0	83.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.7		
# 40	91.9		
# 200	83.9		

* (no specification provided)

Material Description

LEAN CLAY WITH SAND

Atterberg Limits (ASTM D 4318)

PL= 21 LL= 30 PI= 9

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-4(7)

Coefficients

D_{90}= 0.2983 D_{85}= 0.0979 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-3 **Depth:** 4.5 **Date Sampled:**

Materials Testing of Arkansas

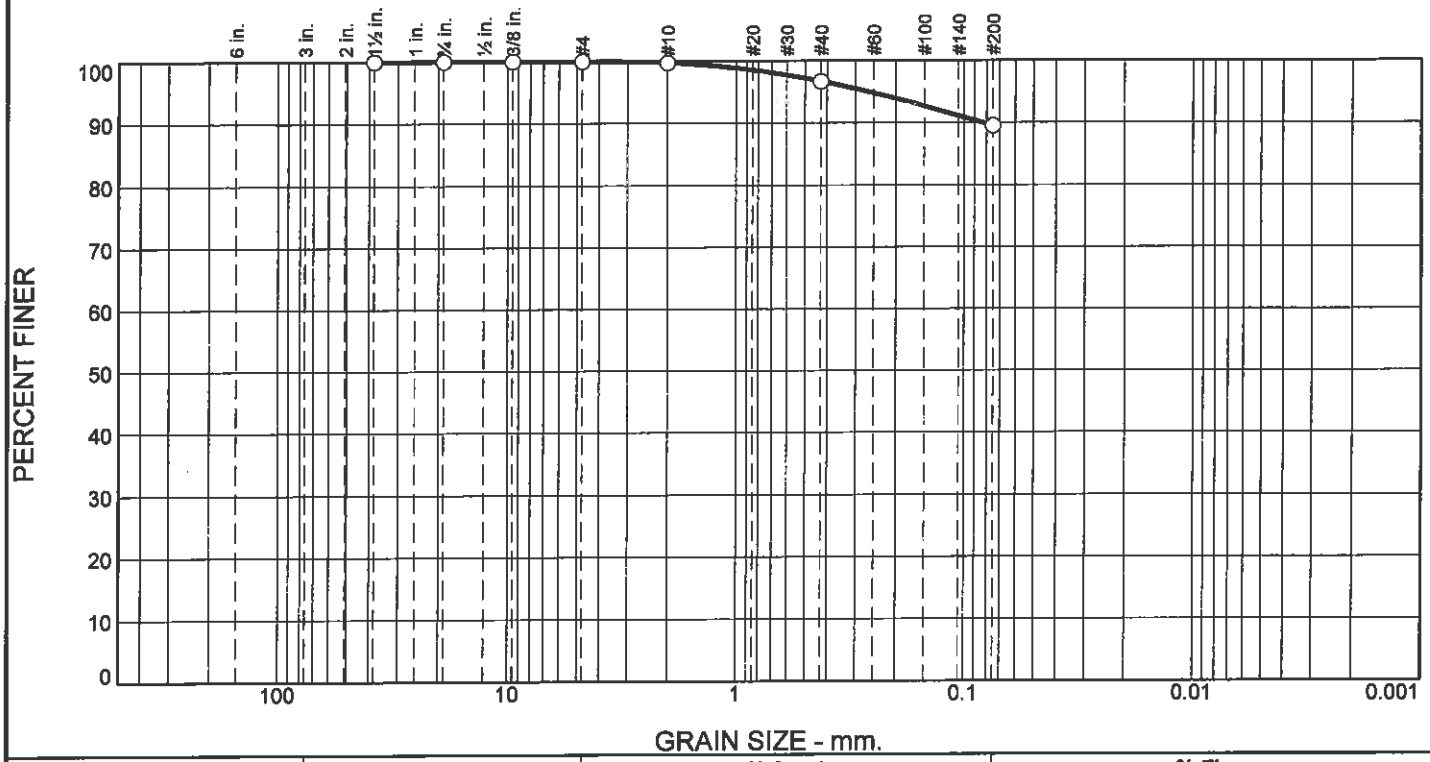
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	3.0	7.2	89.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.7		
# 40	96.7		
# 200	89.5		

* (no specification provided)

Material Description

LEAN CLAY

Atterberg Limits (ASTM D 4318)

PL= 20 LL= 33 PI= 13

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-6(11)

Coefficients

D_{90}= 0.0838 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-3 **Depth:** 6.5 **Date Sampled:**

Materials Testing of Arkansas

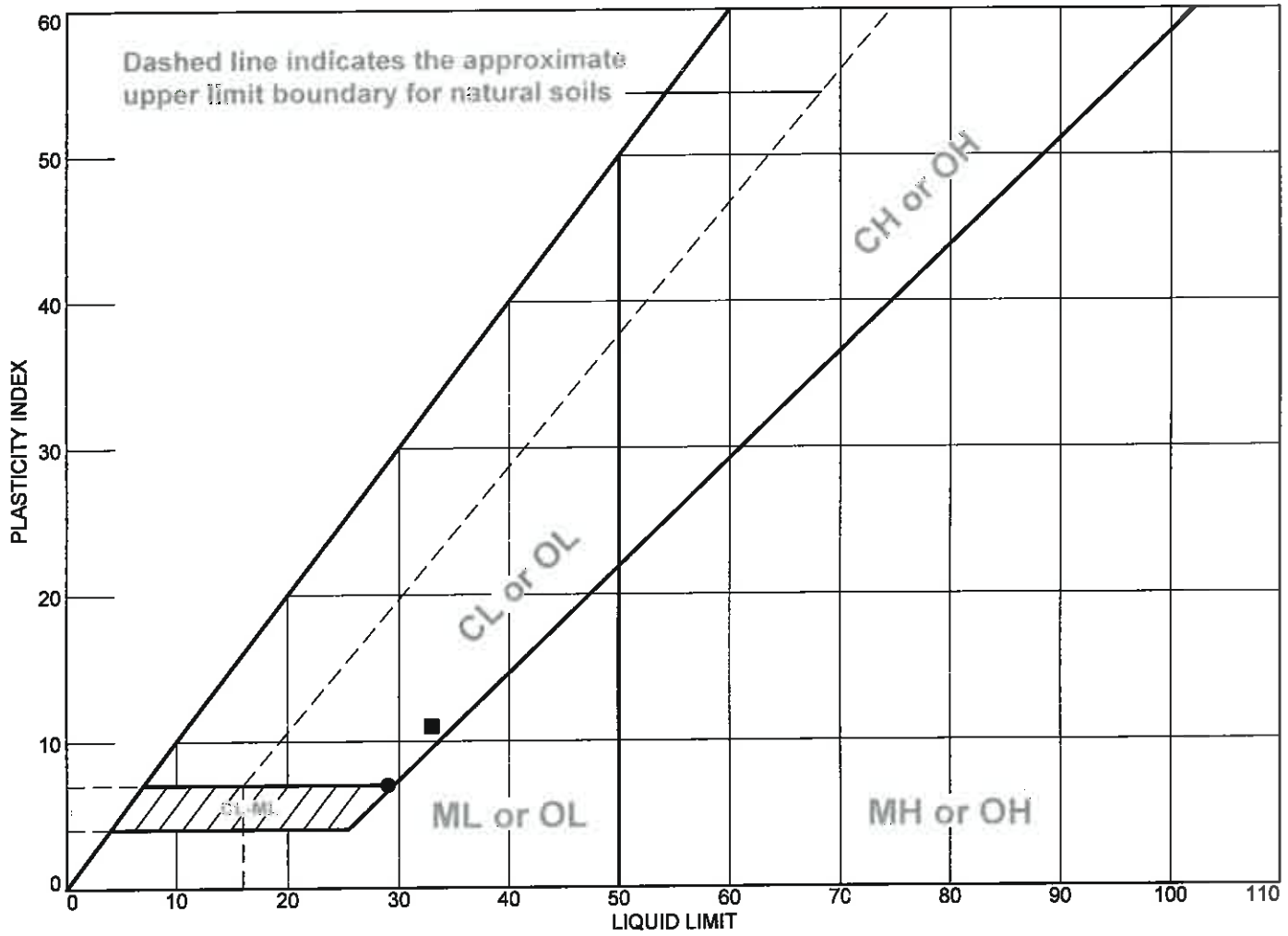
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SILTY CLAY WITH SAND	29	22	7	87.9	80.4	CL-ML
■	LEAN CLAY WITH SAND	33	22	11	92.2	81.2	CL

Project No. **Client:** ETC

Project: FORREST CITY-CITY HALL

● **Source of Sample:** B-4 **Depth:** 2.5

■ **Source of Sample:** B-4 **Depth:** 8.5

Remarks:

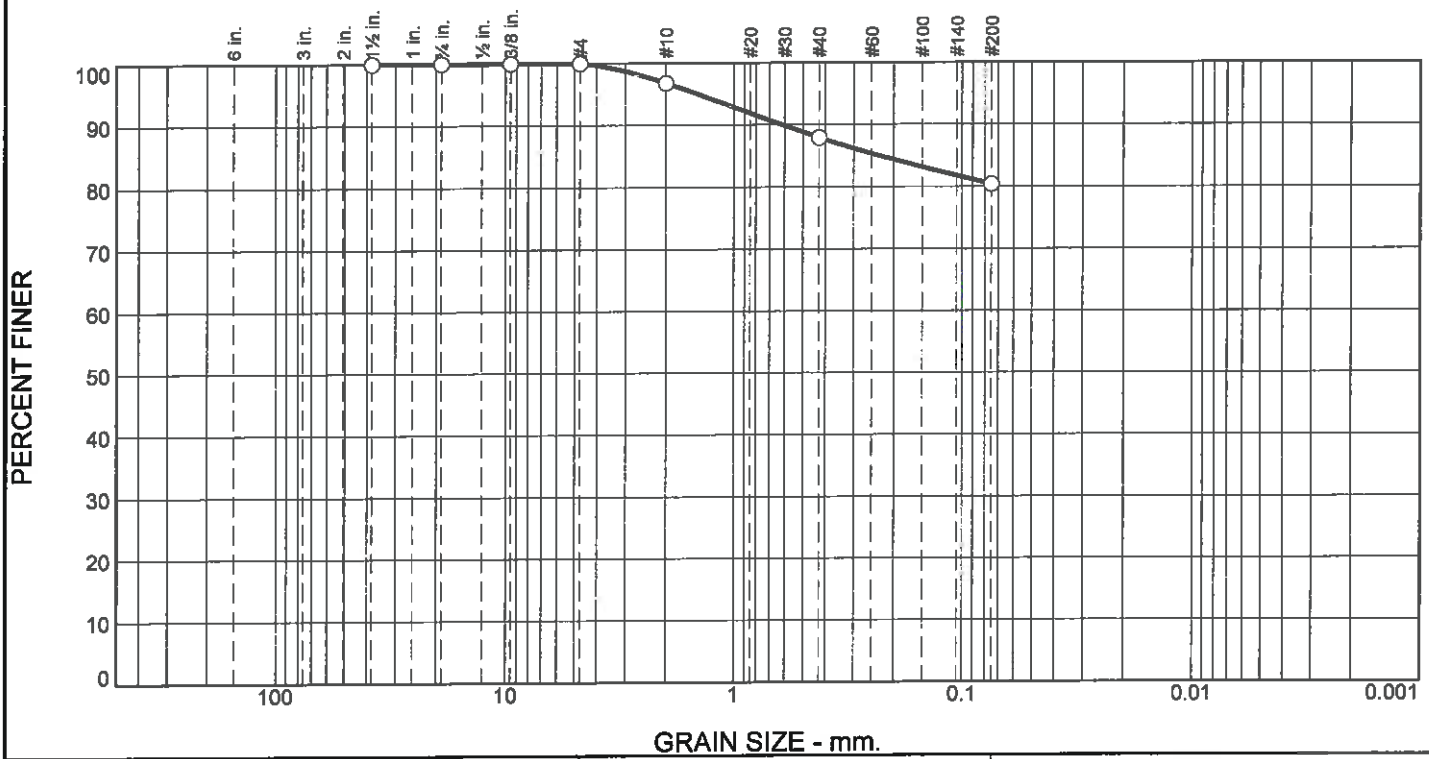
Materials Testing of Arkansas

Little Rock, AR

Figure

Tested By: T. UEKMAN

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.2	8.9	7.5	80.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	96.8		
# 40	87.9		
# 200	80.4		

* (no specification provided)

Material Description

SILTY CLAY WITH SAND

Atterberg Limits (ASTM D 4318)

PL= 22 LL= 29 PI= 7

Classification

USCS (D 2487)= CL-ML AASHTO (M 145)= A-4(5)

Coefficients

D_{90}= 0.6177 D_{85}= 0.2337 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-4 **Depth:** 2.5 **Date Sampled:**

Materials Testing of Arkansas

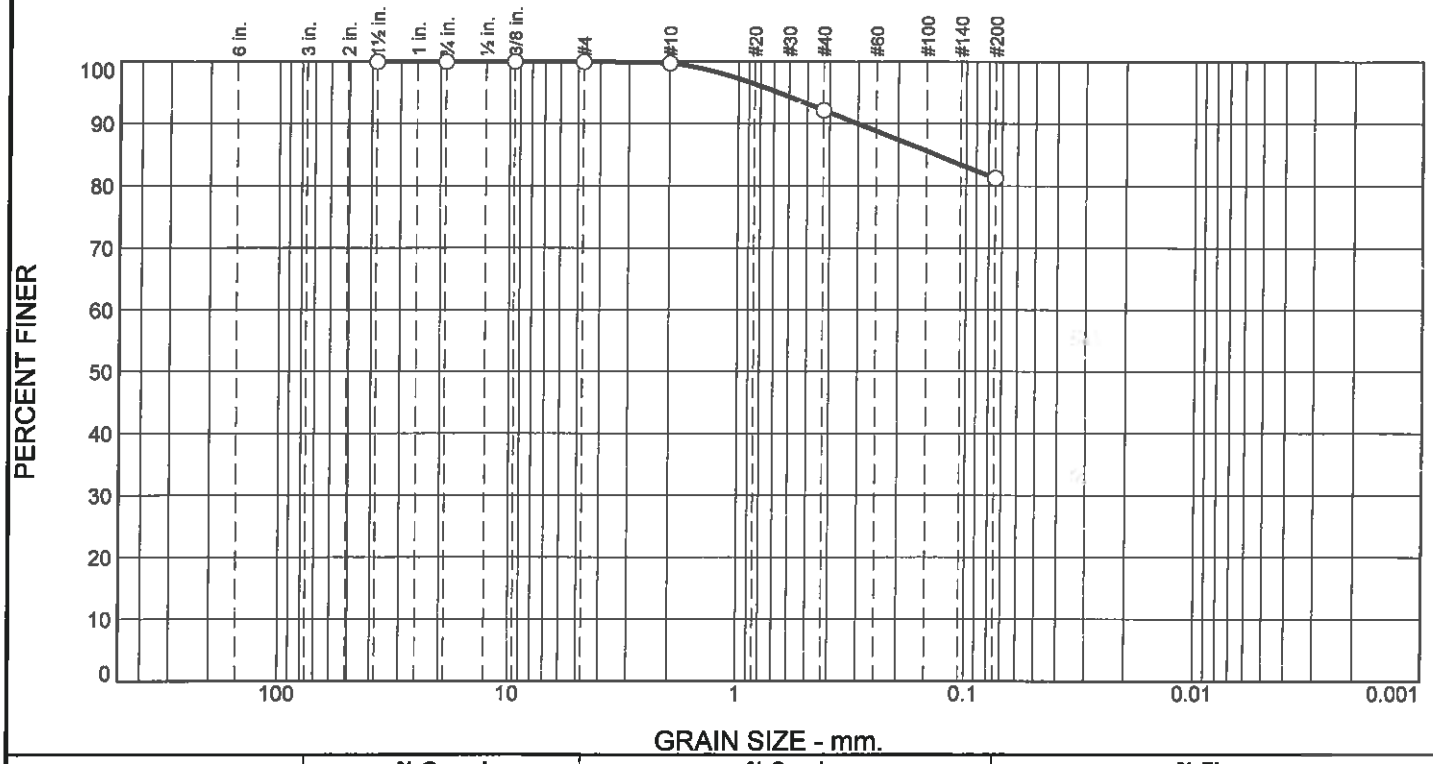
Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	7.5	11.0	81.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1 1/2"	100.0		
3/4"	100.0		
3/8"	100.0		
# 4	100.0		
#10	99.7		
# 40	92.2		
# 200	81.2		

* (no specification provided)

Material Description

LEAN CLAY WITH SAND

Atterberg Limits (ASTM D 4318)

PL= 22 LL= 33 PI= 11

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-6(8)

Coefficients

D_{90}= 0.3022 D_{85}= 0.1369 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8-31-16

Tested By: S. PENNINGTON

Checked By:

Title:

Source of Sample: B-4 **Depth:** 8.5 **Date Sampled:**

Materials Testing of Arkansas

Little Rock, AR

Client: ETC

Project: FORREST CITY-CITY HALL

Project No: **Figure**

SECTION 02110
SITE PREPARATION

PART 1 GENERAL

1.1 PROVISIONS

A. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

A. Work covered by this section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.

B. The Work described in this section of the specifications includes, but is not limited to, the following:

1. Site clearing in preparation for grading and excavation.

2. All debris and surplus soil undercut shall be disposed of off site in strict accordance with governing regulatory agencies. Any dumping in public waters such as lakes, streams, floodways is strictly prohibited. The contractor may be required to present a consent letter from the property owner for permitted dumping.

3. Compliance with applicable air pollution control regulations.

4. Procuring permits for transportation of debris and surplus soil to disposal site, and dust permits.

1.3 SUBMITTALS

A. Permit, Notices, Etc.: Submit for the record copies of permits and notices, and certificates of severance of utility services. No copies will be returned.

1.4 ENVIRONMENTAL CONDITIONS

A. Protect plant growth and features remaining as final landscaping, and bench marks and existing construction from damage or displacement.

B. Maintain designated site access for vehicle and pedestrian traffic.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove following except those designated to remain:

1. Existing surface vegetation and other organic materials.

2. Underground facilities including septic tanks and cesspools.

3. Abandoned utility lines.

4. Construction rubble and debris, existing fill or backfill, and unstable soils within 10 feet of the Building and within driveway and parking lot area.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Perform demolition in accordance with applicable authorities having jurisdiction.

E. Assume possession of materials being demolished, unless indicated otherwise.

F. Carefully remove and deliver materials and equipment to be retained by Owner, such as cornerstones, their contents, commemorative plaques and tablets, to Owner when and where directed.

G. Sprinkle area with water to prevent dust. Provide and maintain hoses and connections to watermain or hydrant.

H. Do not burn materials on site.

I. Pump out buried tanks located outside building proper. Remove tanks and service piping from site.

J. Immediately upon discovery, remove and dispose of contaminated, vermin infested, or dangerous materials by safe means so as not to endanger health of workers and public.

K. Remove trees and shrubs within marked areas, clear undergrowth and dead plant material.

L. Backfill open pits and holes caused by demolition in accordance with Section 02210.

M. Remove demolished materials, tools and equipment upon completion of work. Leave site in acceptable condition.

END OF SECTION

SECTION 02200
EARTH WORK

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included

Excavating, filling, and grading for this work includes, but is not necessarily limited to:

1. Undercutting beneath foundation and slab;

2. Excavating for grade beams;

3. Filling to attain indicated grades;

4. Rough and finish grading of the site;

5. Excavation for drainage system;

6. Excavation at sidewalks.

B. Related Work Described Elsewhere

1.	Quality Control	Section 01400
2.	Site Preparation	Section 02110

C. Definitions

The words “finished grade”, as used herein mean the required final grade elevations indicated on the drawings. Where not otherwise indicated, project site areas outside of building shall be given uniform slopes between points for which finished grades are shown, or between such points and existing grade, except that vertical curves or roundings shall be provided at abrupt changes in slope.

1.2 JOB CONDITIONS

A. Dust Control

1. Use all means necessary to control dust on and near the work.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

PART 2 PRODUCTS

2.1 FILL MATERIAL, GENERAL

Fill material shall be as specified in Part 3 - Execution.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Remove all existing organic topsoil within the root zone, this may be stockpiled and used as a partial requirement for topsoil. It shall be the responsibility of the Contractor to provide the required amount of topsoil. Do not strip topsoil in a muddy condition and avoid admixture of debris. Stock the stripped topsoil within the site at locations approved by the Engineer and where it will not hinder construction operations. Topsoil shall be suitable for plant growth and approved by Architect prior to use at job site.

3.2 ENVIRONMENTAL CONDITIONS

A. Drainage

Special attention shall be given to immediately draining all areas holding surface water and establishing surface drainage before commencing with filling or excavation. Surface drainage shall be maintained throughout the project to prevent surface ponding and subsequent saturation of the subgrade soil.

B. Temporary Drainage

1. Where natural drainage is interfered with, provide temporary drainage system until such time as permanent system is installed and functioning.

2. Temporary drainage system shall be so installed as not to create a nuisance in adjacent property.

3. Keep excavations free of water during entire progress of work, with methods or systems being maintained and properly supervised at all times.

4. Springs encountered shall be brought to the attention of the Engineer. Presence of ground water in the soil shall not constitute a condition for which any increase may be made in the contract price.

3.3 EXCAVATING, FILLING AND GRADING

A. Excavating

1. Grades, Dimensions

   For buildings, excavate to elevations and dimensions indicated, plus ample space for construction operations and inspection of foundation. Remove any soft soil pockets or other unsuitable materials encountered at bearing depth. The site should be proof-rolled with a minimum 20,000 lb. pneumatic-tired roller, loaded tandem-wheeled dump truck, or similar equipment to identify by the proof rolling process areas that should be undercut and be processed and recompacted or replaced with approved select fill.

2. Obstruction

   Remove entirely all obstructions from the locations of new foundations; elsewhere within the lines of new buildings, remove such obstruction a depth of 2' 0" below required grade as shown on the drawings. Clean out any existing dug wells, cisterns, abandoned manholes, catch basins, and other similar structures, and fill with granular material firmly compacted.

3. Classified Excavation

   All excavation under this Section shall be unclassified and no allowance shall be made for classification regardless of the materials encountered. Remove all materials required to perform excavation, including rock, etc.

4. Shore, sheet and/or brace excavations as required by OSHA to maintain them secure, remove shoring as the backfilling progresses, but only when banks are safe against caving. Such shoring shall not constitute a condition for which any increases may be made in the Contract Price.

5. Drainage

   Keep excavations free from water. Do not discharge water from excavations onto privately owned property where harmful erosion will result.

6. Frost Protection

   Make no excavations to the full depth indicated when freezing temperature may be expected, unless the footings or slabs can be poured immediately after the excavation has been completed. Protect the bottom of excavation from frost if placing of concrete is delayed.

7. Disposal

   Remove from the site, and dispose of all debris and all excavated materials not suitable or needed for fill.

8. Bearing Surfaces

Bearing surfaces shall be level, free of all loose material; recompacted to overcome disturbances.

9. After excavations have been dug for indicated footings, notify the Architect prior to placing concrete for his observation.

B. Filling and Grading

1. Grades

Do all cutting, filling, backfilling and grading required to bring the entire project area to subgrades as follows:

a. For surfaces areas: including walks, to the underside of the respective surfacing and/or surfacing base course as fixed by the finished grades.

b. For lawn and planted areas: to 4" below finished grade. Unless otherwise shown on the drawings, slope the subgrade evenly to provide drainage away from building walls in all directions at a grade of 1/4" per foot minimum for at least 10 feet from the building walls.

2. Fill Material

Fill required for backfill or to raise existing grade shall consist of clayey sand (SC), sandy clay (CL), or clayey gravel (GC) having a liquid limit less than 40, or an approved alternative. Fill soils in the building and paving areas and within 5 feet of the building or paving areas shall be compacted to a minimum of 95 percent of maximum Modified Proctor dry density (ASTM D-1557), with a moisture content range of minus 2 to plus 3 percent of optimum.

3. Site Fill

In landscaped areas, compaction criteria may be reduced to a minimum of 90 percent of maximum Modified Proctor dry density (ASTM D-1557) at a moisture content near optimum. Fill should be placed in maximum 8-inch loose lifts. Each lift of fill should be properly compacted, tested, and approved prior to placing subsequent lifts.

4. Place fill in uniform layers. Fill shall be placed in loose lifts no greater than 8" in thickness and properly compacted as specified under building

and pavements. The in-place density and moisture content shall be established for each lift prior to placement and subsequent lifts. Compact "cut" or "virgin" material on which fill material is to be place shall be proof-rolled to verify stability prior to placing fill material. If a thick initial lift is used for "bridging" over soft pockets the top 8" of the initial lift shall be compacted to the density required for the fill above.

5. Sand

   Washed river sand free of all foreign matter.

6. Gravel Drainage Fill

   Washed river gravel, graded from 1/4" to ½"; (1" to 2" for use around trees). Gravel shall be thoroughly consolidated with vibrating equipment.

7. Top soil 4" deep at non-paved areas.

3.3 DISPOSITION OF UTILITIES

Rules and regulations governing the respective utilities shall be observed in executing all work under this heading. Active utilities shown on the drawings shall be adequately protected from damage, and removed or relocated only as indicated or specified. Active utilities not shown on the drawings shall be protected or relocated in accordance with written instructions of the Engineer. Inactive and abandoned utilities encountered in excavating and grading operation shall be removed, plugged or capped. In absence of specified requirements, plug or cap such utility lines at least 3 feet outside of new building walls or as required by the local regulations.

3.4 FINISH GRADING

Remove all debris and re-grade as necessary to bring rough grade to a uniform surface. Spread topsoil to a minimum depth of 4" over all areas that were graded (cut or filled) which are not to be paved. All areas 10' from new construction, shall require 4" of topsoil. Grade to a smooth uniform surface conforming to finish grades or cross sections indicated on the drawings. Clean finished surface of all stones, roots, or other undesirable foreign matter and remove from project site.

3.5 GENERAL

Complete the grading operations after buildings have been finished, utilities installed, site improvement constructed, and all materials, rubbish and debris removed from the site. Leave subgrade for lawns and planted areas clean and at required grades.

END OF SECTION

SECTION 02210
GRADING

PART 1 GENERAL

1.1 PROVISIONS

Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

A. Work covered by this section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.

B. The Work described in this section of the specifications includes, but is not limited to, the following:

Preconstruction excavation, stockpiling and disposal of topsoil and subsoil, grading and contouring of site in preparation for streets and parking areas and compaction of subgrade soils.

1.3 RELATED WORK

The following items of related work are specified and included in other sections of these specifications:

A. Section 02110 - Site Preparation.

1.4 REFERENCE STANDARDS

A. ASTM D698-Latest - Tests for Moisture-Density Relations of Soils and Soil AggregÂate Mixtures using 5.5 lb. hammer and 12 inch drop.

B. ASTM D1557-Latest - Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10 lb. hammer and 18 inch drop.

1.5 SUBMITTALS

A. Project Record Documents:

1. Maintain existing utilities and accurately record location of newly encountÂered utilities remaining, rerouted utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 TESTING

The Owner shall employ a testing laboratory to perform soil testing and inspection service for quality control during undercutting, compacting, compaction and fill.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill: Clean soils free of vegetation, debris and organic contaminates with:

1. No fragment larger than 3 inches in size.

2. 100 percent passing 3 inch sieve.

3. 50 to 100 percent passing No. 4 sieve.

4. 20 to 60 percent passing No. 200 sieve.

5. No more than 1.5 percent expansion performed on samples molded to 95 percent of maximum ASTM D698 density and 3 percent below optimum moisture submerged and confined under 100 psf surcharge pressure.

6. Maximum plasticity index of 15 as determined in accordance with ASTM D4318.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify and maintain required lines, levels, contours, and baseline points.

B. Identify, maintain and protect existing utilities which pass through construction area. Call One-Call at 1-800-482-8995 and have all utilities located prior to clearing and grubbing or excavating.

C. Notify utility company and have utilities removed and relocated when required for construction. No standby time will be paid for due to delay caused by the utilities companies in relocation of any lines.

3.2 STRIPPING

A. During dry periods, remove the upper 6 inches of topsoil from areas to be further excavated, landscaped or regraded. Stockpile topsoil for reuse.

B. All soft or organic soil should be stripped from areas which are to be paved. A stripping depth of 6 - 12 inches is anticipated.

C. Grass, grass roots and incidental topsoil shall not be left beneath a fill area nor shall this material be used as fill material. If acceptable, the material may be stockpiled for later use in areas where topsoil is specified.

D. Stripping shall be performed with low ground pressure track-mounted equipment

E. The use of heavy rubber-tired vehicles within the pavement subgrade areas should be limited.

3.3 EXCAVATION

A. After stripping has been completed, excavate to elevations and grades indicated.

B. Widen depressions to accommodate compaction equipment and provide a level base for placing fill.

C. Remove unsuitable and surplus material from the site in accordance with Section 02110 - SITE PREPARATION.

3.4 UNDERCUT

A. Prior to placing fill for the driveway, the contractor shall establish the location and limits of weak zones by proof rolling the areas which will receive fill with a minimum 20,000 lb pneumatic tired roller, loaded dump truck or similar equipment. The Engineer shall observe and agree to the limits of weak material to be replaced. Any zones indicating significant rutting or pumping shall be excavated and removed from the site. The depth of excavation (undercut) may exceed 3 feet within the parking and drive area. The Engineer shall be notified when excavation to solid material is completed so he can agree on the quantity of backfill required. If solid material is not encountered within five (5) feet of the surface, the contractor shall have the option of bridging over the weak zone by using a thick initial lift of granular fill.

B. After areas have been excavated to the required grades, the contractor shall locate weak zones by proof rolling and undercut those areas as described in subparagraph A above. Weak zones identified beyond the required grades will be undercut on a unit cost basis and paid by change order.

3.5 FILL

A. Fill material required for backfill or to raise existing grade shall consist of select clayey sand (SC) or clayey gravel (GC) or sandy clay (CL) with liquid limit less than 40.

B. Place and compact fill material in continuous layers not exceeding eight (8) inches loose depth. Maintain optimum moisture content in fill materials to obtain required compaction density.

C. Deeper lifts may be authorized when proposed equipment is proven to compact deeper lifts.

D. Controlled fill shall not be constructed when the atmospheric temperature is below 35Â°F. When the temperature falls below 35Â°F, it shall be the responsibility of the contractor to protect all areas of completed surface against any detrimental effects of ground freezing by methods approved by the geotechnical engineer. Any areas that are damaged by freezing shall be reconditioned, reshaped, and compacted by the contractor in conformance with the requirements of this specification without additional cost to the Owner.

3.6 COMPACTION

A. Use mechanical compaction equipment which will not disturb adjacent structuÂres. Do not use water settling and jetting methods.

B. Compact fill materials under buildings in accordance with ASTM D1557.

C. Rework, moisten or dry as required, and compact exposed surface and subgrade soils to a minimum depth of 8 inches. Reworking may be accomplished by scarification, dicing, removal and replacement or other method which will result in uniform moisture contents and densities.

D. Compact soils within following ranges of moisture content:

2 percent below to 3 percent above optimum

E. Compact fill materials other than under buildings to following minimum percent compaction:

At least 95% of maximum standard proctor dry density (ASTM D 698)

3.7 SUBGRADE PREPARATION

Maintain subgrade of areas to be covered with structural fill or aggregate base course in moist condition until covered.

3.8 GRADING TOLERANCES

A. Subgrade: Within 0.10 feet from grades and cross section indicated.

B. Variations Within Tolerances: Compensating so that average grade and cross-section are met.

3.9 OBSERVATION AND TESTING OF WORK

A. Observation and testing shall be performed by an independent geotechnical testing laboratory.

B. Testing shall be performed so as to least encumber construction.

C. When tests indicate that compacted materials do not meet specified requiremÂents, correct defective construction, and have construction retestÂed.

D. Compacted fills must be tested and must meet compaction requirements before proceeding with placement of surface materials.

E. Tests of fill materials and embankments will be made at the following minimum rates:

1. One field density test for each 500 square yards of original ground surface prior to placing fill.

2. One field density test for each 250 cubic yards of fill placed or each layer of fill for each work area, whichever is the greater number of tests.

3. One moisture-density curve for each type of material used, as indicated by sieve analysis and plasticity index.

4. The geotechnical engineer shall submit, daily, the results of field density tests required by these specifications.

3.10 PROTECTION

A. Protect trees, shrubs, and other features designated to remain.

B. Protect bench marks, property monuments, walls, fences, roads, sidewalks, paving and curbs.

C. Protect above or below grade utilities which are to remain.

D. Protect newly graded areas from traffic and erosion, keep areas free of trash and debris. Repair and reestablish grades in settled, rutted, or eroded areas.

E. Repair all damage caused by construction activities and/or others.

END OF SECTION

SECTION 02220
EXCAVATING, BACKFILLING AND COMPACTING

PART 1 GENERAL

1.1 PROVISIONS

Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

A. Work covered by this Section includes furnishing all labor, materials, services, appliances, licenses, taxes, and equipment necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.

B. The Work described in this section of the specifications includes, but is not limited to, the following:

1. Excavating, backfilling and compacting for structures, utilities, driveways, curbs, gutters, sidewalks and other hardscape.

1.3 RELATED WORK

A. The following items of related work are specified and included in other sections of these specifications:

1. Section 02110 - SITE PREPARATION.

2. Section 02210 - GRADING.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill: In accordance with Section 02210.

B. Bedding Material: Granular material containing no pieces larger than 3/4 inches and free of broken concrete pavement, wood or other deleterious materials. Do not use open graded rock unless approved; sum of plasticity index and percent of material passing No. 200 sieve not to exceed 23.

C. Base Course: Gravel aggregate base course.

1. Gravel: Fully or partially rounded and water-worn particles with uniformly distributed crushed rock exceeding ASTM D422 maximum gradation sizes as follows:

a. 100% passing 1 inch sieve by weight.

b. 85% to 100% passing 3/4 inch sieve by weight.

c. 45% to 95% passing No. 4 sieve by weight.

d. 10% to 40% passing No. 30 sieve by weight.

e. 0% to 8% passing No. 200 sieve by weight.

2. Maximum plasticity index of 3 when tested in accordance with ASTM D4318.

3. Maximum percent of wear of 50 when subjected to Los Angeles abrasion test (ASTM C131).

PART 3 EXECUTIONS

3.1 PREPARATION AND LAYOUT

1. Maintain baseline points and other reference points throughout the project. Any control point destroyed during the construction shall be re-established by the contractor..

2. Stake limits of excavation horizontally and vertically by using furnished baseline points.

3.2 PROTECTION

A. Protect areas to receive planting, and other features specified to remain.

B. Protect baseline points existing structures, roads, sidewalks, paving, and curbs from damage by equipment and vehicular or foot traffic.

1. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods, as required to prevent cave-ins or loose dirt from falling into excavations.

C. Underpin adjacent structures which may be damaged by excavation work, including service lines and pipe chases.

D. Notify Engineer of unexpected subsurface conditions and discontinue work in area until Engineer provides notification to resume work.

E. Protect bottom of excavations and soil around and beneath foundations from frost.

F. Grade around excavations to prevent surface water run-off from flowing into excavated areas.

3.3 UTILITIES

A. Before starting excavation, contact A One Call@ at 1-800-482-8998, establish location and extent of underground utilities occurring in work area.

B. Maintain existing utility lines designated to remain within the work area.

C. Include costs for maintaining utilities in bid.

D. Protect utility services uncovered by excavation.

1. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

E. Accurately locate (tie to control points)and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

3.4 TRENCHING FOR UTILITIES

1. Do not disturb soil within branch spread of existing trees or shrubs designated to remain. When necessary to excavate through roots, excavate by hand, tunnel through roots where Possible and cut roots with sharp ax where tunneling is not possible.
2. Where trenches lie within concrete or asphaltic concrete pavement sections, sawcut to neat, vertical, true lines without damage to adjoining surfaces.
3. Accurately grade trench bottom to specified lines and grades and provide uniform bearing and support for each section of pipe at every point along its entire length. Trim and shape trench bottoms and leave free of irregularities, lumps and projections.
4. Brace, sheath or shore as necessary to perform and protect excavation and personnel.
5. Minimize length of open trench whenever possible.
6. Cut trenches sufficiently wide to enable proper installation of services and to allow for inspection, but not in excess of following maximum widths at top of pipe greater than O.D. of barrel and minimum widths at spring line each side of pipe:

   1. For Pipe Less than 18 inches (I.D.): 16 inches at top and 6 inches at spring line.

   2. For Pipe from 18 through 24 inches (I.D.): 19 inches at top and 7-1/2 inches at spring line.

   3. For Pipe from 27 through 39 inches (I.D.): 22 inches at top and 9 inches at spring line.

   4. For Pipe from 42 through 60 inches (I.D.): Half O.D. at top and 12 inches at spring line.

   5. For Pipe over 60 inches (I.D.): 36 inches at top and 12 inches at spring line.

7. Dig bell or coupling holes after grading trench only as necessary to permit accurate work in making joints.

8. Refill unauthorized excavation below specified grade with aggregate base material and compact to uniform density of 95%.
9. When excavations are complete, request and receive inspection. Correct unauthorized excavation.
10. For pipe 12 inches or greater in diameter, provide initial granular bedding at least 4 inches thick or 1/12 outside diameter of pipe whichever is greater. Place bedding material at uniform density with minimum compaction. Granular bedding for pipes less than 12 inches in diameter shall be 3" thick.

11. Excavate for manholes, valves, inlets, catch basins and other accessories. Structures may be placed directly against excavated earth when excavated faces are firm and unyielding, and outside structure line. Overexcavate unacceptable native material, backfill with aggregate base material and compact. Request and receive inspection of excavation prior to pouring concrete.
12. Stockpile excavated soil for reuse where directed. Remove excess or unsuitable excavated soil from site.

3.5 DEWATERING

A. Keep trenches dry. Provide necessary equipment including pumps, piping and temporary drains.

B. Do not discharge drainage water lines into municipal sewers without municipal approval. Ensure water discharge does not contain silt held in suspension.

C. Control grading in and adjacent to excavations to prevent water from running into excavated areas or onto adjacent properties or public thoroughfares.

D. Furnish and operate suitable pumps on 24 hour basis to keep excavations free of water until after installing utility service and backfilling.

3.6 BACKFILLING UTILITY TRENCHES

A. Do not start backfilling until services have been inspected and approved.

B. Keep building debris and water out of trenches.

C. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

D. Place fill materials in accordance with governing utility company requirements. Use method which will not disturb or damage services.

E. Maintain optimum moisture content of fill materials so as to attain required compaction density.

F. From bottom of trench to 12 inches above top of pipe compact to minimum of 95% maximum dry density.

G. From 12 inches above top of pipe to 24 inches below surface compact fill to minimum of 95% maximum dry density.

H. Compact upper 24 inches to 100% maximum density for granular soils, 95% maximum density for nongranular soils except in areas where solid sodding or seeding is required. In those areas the top 6 inches shall be topsoil compacted to the density of adjacent soil.

I. Remove surplus fill materials from site.

J. Compact fill at trenches where footings occur to 95% maximum density.

3.7 EXCAVATION FOR PAVEMENT DRIVEWAYS, CURBS AND GUTTERS, SIDEWALKS, AND OTHER HARDSCAPE

A. Remove debris and loose material.

B. Excavate:

1. Unstable material outside planned improvement or ditch slopes which constitutes potential slides.

2. Material which has deposited on improvement site or in ditch.

3. Material which has slipped out of embankments.

C. Excavate material to grades indicated.

D. No point on the completed slope shall vary from the designated plane by more than one inch as measured at right angles to the slope, except where otherwise indicated.

E. Do not encroach on road bed or parking area.

F. Round tops, toes and ends of excavation slopes.

3.8 COMPACTION, TOLERANCES

A. Compact soils under improvements in accordance with Section 02210 - GRADING.

B. Grading tolerances under improvements shall be in accordance with Section 02210 - GRADING.

3.9 SURPLUS AND UNSUITABLE MATERIALS

A. Dispose of materials in accordance with regulatory requirements specified in Section 02110 - SITE PREPARATION.

B. Quantities when shown or specified are approximate.

3.10 OBSERVATION AND TESTING OF WORK

A. Conform to requirements specified in Section 02210 - GRADING

B. One field density test for each 100 lineal ft. of trench backfill per lift shall be performed, unless directed otherwise.

END OF SECTION

SECTION 02223

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 WORK INCLUDED IN THIS SECTION

This section shall consist of excavation of trench, bedding of pipe and backfilling of trench.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Not applicable.

1.3 QUALITY ASSURANCE

A. Materials which have been rejected shall be removed from the job site.

B. Bedding or backfill that do not conform to the specifications shall be removed or reworked until the specifications are met.

1.4 PROTECTION

A. Existing Property - The contractor shall exercise reasonable care in excavating trenches for water lines or sewer force mains in order not to interfere with or damage existing improvements on public or private property. Any property damaged shall be replaced by the contractor at his own expense.

B. Existing Utilities

1. The contractor shall be responsible for determining the exact location of existing utilities within the work area.

2. Any utility line that is cut must be reported to the Owner and repaired immediately in order to maintain service to the customers. These repairs are considered part of the pipe laying cost and will not be paid for separately.

3. The contractor shall coordinate with the utility company and the Owner in the event that utilities must be shut off.

1.5 SITE CONDITIONS

A. Excavations

1. Trenches and other excavations more than five feet deep (or less when hazardous ground movement is expected) shall be shored, laid back to a stable slope or some other means of protection provided (such as trench boxes) where employees may be exposed to moving ground or cave-ins.

2. Additional precaution (shoring or bracing) shall be installed when trenches are exposed to vibrations (railroad, highway or machinery) or adjacent to backfill. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically and be secured.

3. Trenches over five feet deep shall have ladders or stairs every 50 feet.

4. In all events all excavations and trenches shall be in compliance with all codes and ordinances especially the OSHA "Construction Standards for Excavations" 29CFR Part 1926.650 through 1926.652 Subpart P.

B. Dewatering - If dewatering is required, the contractor shall exercise care not to allow water to damage existing property or damage bedding.

PART 2 PRODUCTS

2.1 BEDDING

Pipe Bedding - Shall consist of pea gravel.

2.2 BACKFILL

A. PIPE - Initial backfill material shall consist of pea gravel.

B. Remaining backfill (called general backfill) shall be select material free of stones (maximum particle size of 6 inches). Stones or rock larger than 6 inches shall be removed from the work site.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

A. Trenches shall be excavated to the depth specified. In the event rock is encountered in the excavation, the trench must be excavated to a depth not less than six (6) inches below grade and then filled back to grade with bedding material. Additional payment will be allowed for excavation of rock on a unit price basis by a change order.

B. Trench Width - (1) Water mains shall be of sufficient width for the proper installation of the pipe. Maximum widths are as follows:

PIPE SIZE	TRENCH WIDTH (Maximum)
1" - 3"	18"

3.2 DEPTH OF TRENCH

Except when otherwise shown on the drawings, or herein specified, all pipe trenches shall be constructed to a minimum depth of 36 inches. Pipe shall be laid deeper whenever necessary in order to avoid obstructing other lines.

3.4 METHOD OF PAYMENT AND MEASUREMENT

A. Trenching for pipes shall be subsidiary to the other items. Trenching will not be measured or paid for separately.

B. Rock excavation shall be subsidiary to the trenching and shall be included in the lump sum price and will not be paid for separately.

C. All items of work in this section shown on the plans or called for in the specifications which are not given in the list of variable quantities shall be included in the various unit contract prices of work.

END OF SECTION

SECTION 02232

SUBGRADE

PART 1 GENERAL

1.1 PROVISIONS

A. Requirements of the General Provisions apply to all work under this section.

1. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

This item shall consist of shaping, compacting and otherwise preparing the completed roadbed for the placing of base and surface courses and pavements in accordance with these specifications and in substantial conformity with the lines, grades, and cross sections shown on the Plans.

PART 2 PRODUCT (Not Applicable)

PART 3 EXECUTION

3.1 The subgrade shall be prepared in such manner as to insure that the base, surface course, or pavement will be placed on a firm foundation that is stable and reasonably free from dust pockets, wheel ruts and other defects.

The subgrade area shall be scarified as may be necessary for shaping, and shaped and compacted to the required grade and section. The top eight (8) inches of the subgrade shall be compacted to a density, as determined by AASHTO T 191, of not less than 95% of the maximum density obtained by AASHTO T 99. This compaction shall be accomplished by any satisfactory method or methods that will obtain the required density. The Contractor shall bring the moisture content of the material to be compacted to substantially that of optimum moisture by the addition of water or by manipulation and aeration as it may be necessary to increase or decrease the moisture content under the conditions encountered.

The density requirements specified above will not apply to subgrade for unbound granular type surface courses.

Compaction operations may be dispensed with when an old stone or gravel roadbed is used as a foundation or subgrade for a base course or pavement where scarifying for shaping is unnecessary and its stability is approved by the Engineer.

Existing bituminous surface course in place shall be scarified and the material broken down to a maximum size of two (2) inches and shaped and compacted to the required grade and section after being thoroughly mixed with any base course material that may be in place unless the Engineer considers the existing surface suitable for retention.

All soft and yielding material and other portions of the subgrade which will not compact readily when rolled or tamped shall be removed. Holes or depressions made by the removal of unsuitable material as directed above shall be filled with an approved material and the whole subgrade brought to the lines, grade and cross section shown on the plans and compacted to the required density.

If the succeeding course is not placed immediately after the subgrade has been prepared and the subgrade becomes cut up, rough, or unstable, it shall again be shaped and recompacted in accordance with the above requirements.

END OF SECTION

SECTION 02233

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 PROVISIONS

A. Requirements of the General Provisions apply to all work under this Section.

B. Throughout the specifications, types of materials may be specified by manufacturers name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

This item shall consist of a foundation course for surface courses pavements. It shall be constructed on the prepared subgrade or other completed base course in accordance with these specifications, and in substantial conformity with the lines, grades, compacted thickness and typical cross section shown on the Plans.

PART 2 PRODUCTS

2.1 MATERIALS

This material shall consist of crusher run stone or a mixture of crushed stone and natural fines uniformly mixed and so proportioned as to meet all the requirements hereinafter specified, with further provisions that a mixture of crushed stone and natural fines shall contain not less than 90 per cent crusher produced material. The stone shall be hard and durable with a percent of wear by the Los Angeles Test (AASHTO T 96) not greater than 45. For the purpose of this specification, shale and slate are not considered to be stone. The material furnished shall not contain more then 5% by weight of shale, slate, and other objectionable, deleterious, or injurious matter.

The class or classes of crushed stone base course material that may be used on any particular job will be those called for on the proposal schedule.

GRADING REQUIREMENTS

Size of Sieve	Percent by Weight	
Total Retained	Class SB-2	Class SB-3

1-1/2"	0	0
1"	0	0
3/4"	10-50	0-35
#4	45-75	45-75
Total Passing		
#40	10-30	10-30
#200	3-10	3-10

The fraction passing the No. 200 sieve shall not be greater than two-thirds the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

When it is necessary to blend two or more materials, each material shall be proportioned separately through mechanical feeders to insure uniform production. Premixing or blending in the pit to avoid separate feeding will not be permitted.

The blending of materials on the roadway in order to obtain a mixture that will comply with the above requirements will not be permitted.

PART 3 EXECUTION

3.1 GENERAL

1. The base course material shall be placed on a completed and approved subgrade or existing base that has been bladed to substantially conform to the grade and cross section shown on the plans.
2. The subgrade shall be prepared as specified in Section 02232, and shall be free from an excess or deficiency of moisture at the time of placing the base course. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the contract that provide for the construction or shaping of the subgrade or the reconstruction of the existing base course.
3. Base course material shall not be placed on a frozen subgrade or subbase.

4. The crushed stone shall be placed on the subgrade or other base course material and spread uniformly to such depth and lines that when compacted it will have the thickness, width and cross section shown on the plans.
5. If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. When vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of the base course may be increased to 8 inches upon approval.
6. The spreading shall be done the same day that the material is hauled, and it shall be performed in such manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping the crushed stone on the subgrade will exist. To insure proper mixing, the crushed stone shall be bladed across the roadbed before being spread. Care must be taken to prevent mixing of subgrade or shoulder material with the base course material in the blading and spreading operation.
7. Each course shall be compacted by any satisfactory method that will obtain the density herein specified. The crushed stone shall be substantially maintained at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary. The specified grade and section shall be maintained by blading throughout the compaction operation. The density of the compacted material in each course, as determined by AASHO T 191, shall not be less than 100% of the density obtained in the laboratory. The crushed stone shall be compacted across the full width of application.
8. The laboratory density shall be obtained as follows: the sample is prepared by removing the aggregate passing the Â¾â€ inch sieve and retained on a #4 sieve in an amount equal to that removed. The sample so prepared is compacted at various water contents in five equal layers in a mould 6 inches in diameter and 7 inches high. Each layer is compacted by 55 blows of a 10 pound hammer 2 inches in diameter dropped at a height of 18 inches. The density used is the dry weight obtained at the optimum water content.

3.2 The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and recompacting to the specified density, as directed.

3.3 Where neither prime coat, surfacing, nor pavement are provided in the same contract with the base course, the density requirement for the base course will be waived and no compaction will be required beyond that obtained by systematic maintenance under traffic.

3.4 The Contractor shall maintain the base course in a satisfactory condition until accepted.

END OF SECTION

SECTION 02285 - SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

Approval is required for submittals.

A. Data

Manufacturer's label and Material Safety Data Sheet (MSDS) for pesticides proposed for use.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Pesticides shall be delivered to the project site in sealed and labeled containers in good condition as supplied by the manufacturer or formulator. Pesticides shall be stored, handled, and used in accordance with manufacturer's labels. Labels shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended.

1.4 SAFETY REQUIREMENTS

A. The Contractor shall formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Water for formulating shall only come from sites as designated, and filling hose shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Pesticides and related materials shall be kept under lock and key when unattended. Proper protective clothing and equipment shall be worn and used during all phases of termiticide application.

1.5 WARRANTY

A. The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the building addition. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

B. Re-treat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

C. Repair damage caused by termite infestation; and

D. Re-inspect the building approximately 180 days after the retreatment.

PART 2 - PRODUCTS

2.1 MATERIALS

Termiticides shall be currently registered by the EPA/Arkansas State Plant Board.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

At the time of application, the soil moisture content shall be sufficiently low to allow uniform distribution of the treatment solution throughout the soil. Applications shall not be made during or immediately following heavy rains or when conditions may cause runoff and create an environmental hazard.

3.2 APPLICATION

A. Treatment of New Structures

The Contractor shall establish complete and unbroken vertical and/or horizontal (as necessary) soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas intended for use as a plenum air space. Surface treatments shall not be made for areas to serve as crawl spaces. Termiticide shall be applied as a coarse spray and provide uniform distribution unto the soil surface. Treatment shall be applied prior to placement of a vapor barrier or waterproof membrane and at least 12 hours prior to concrete placement. Where treated soil or fill material is not to be covered with a vapor barrier or waterproof membrane, adequate precautions shall be taken to prevent its disturbance. Soil or fill material disturbed after treatment shall be re-treated as specified above before placement of slabs or other covering structures. Treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures shall be coordinated with final grading and planting operations so as to avoid disturbance of the treated barriers. Manufacturer's warnings and precautions shall be observed in the handling and use of such materials. Care shall be taken to prevent these chemicals from entering water supply systems, potable water supplies, or aquifers; and that they do not endanger plants or animals.

B. Treatment of Existing Structures

The Contractor shall establish complete and unbroken vertical and/or horizontal (as necessary) soil poison barriers between the soil and all portions of the structure which may allow access to wood and wood related products. This barrier may be established by rodding, trenching and/or injection as necessary. No pesticides shall be applied to the soil beneath a plenum air space or surface applied to crawl spaces. Chemicals shall not be applied until the location of heat

or air conditioning ducts, vents, and water, sewer, and plumbing lines are known and identified. Extreme caution shall be taken to avoid contamination of these structural elements and airways.

C. Rates and Methods of Application
Rates and methods of application shall be in accordance with the manufacturer's instructions on the pesticide label. Maximum application or dosage rates shall be used. If the pesticide contains less than the amount of active ingredient specified on the label, work shall be repeated with pesticides conforming to this specification.

3.3 DISPOSAL

The Contractor shall dispose of residual pesticides and containers off Government property in accordance with label instructions and EPA criteria.

END OF SECTION

SECTION 02511
CONCRETE SIDEWALKS AND CURBS AND GUTTERS

PART 1 SCOPE

1.1 PROVISIONS

A. Requirements of the General Provisions apply to all work under this section.

B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

This item shall consist of construction of all sidewalks, curbs and gutters as shown on the drawings.

1.3 RELATED WORK

The following items of related work are specified and included in other sections of these specifications:

A. Section 02210 – GRADING

B. Section 02220 - EXCAVATING, BACKFILLING, AND COMPACTION

C. Section 02513 - PORTLAND CEMENT CONCRETE PAVING

D. Section 03300 –CONCRETE WORK

PART 2 PRODUCTS

2.1 CONCRETE

A. Strength - Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

B. Air Content - Mixtures may have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.2 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.3 JOINT FILLER STRIPS

A. Contraction/Expansion Joint Filler.

B. Joint filler shall be Omniseal as manufactured by Sonneborn or approved equal

C. Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, ½ inch thick, unless otherwise indicated.

2.4 FORM WORK

Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of three welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

A. Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

B. Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

2.5 REINFORCEMENT STEEL

Reinforcement steel shall be as specified in Section 02513 - PORTLAND CEMENT CONCRETE PAVING.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement.

A. Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

B. Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

C. Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING AND REMOVAL

Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed.

A. Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope of 2% (maximum) with the low side adjacent to the roadway, unless otherwise shown on the drawings. Side forms shall not be removed for 24 hours after finishing has been completed.

B. Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is plastic enough to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

A. Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

B. Formed Sidewalks

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

C. Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

D. Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joints including those used for handicapped ramps shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

A. Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

B. Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes.

The edges of the gutter and the base edge of the top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

C. Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and in line with expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

A. Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

B. Expansion Joints

Expansion joints shall be formed with 3/8-inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Concrete at the joint shall be surface dry and the atmospheric and pavement temperatures shall be above 50 degrees F at the time of application of joint-sealing materials. Joints shall be filled with sealer flush with the concrete surface in such manner as to avoid spilling or smearing onto the walk surface.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

A. Contraction Joints

Contraction joints shall be constructed in line with contraction joints in abutting Portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8-inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

B. Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter in line with expansion joints of abutting Portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut Portland cement concrete pavement, expansion joints at least 3/8 inch in width shall be provided at intervals not exceeding 30 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated.

END OF SECTION

SECTION 02513
PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 PROVISIONS

Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings. The covered work includes excavating and compacting of subgrade, and forming, placing and curing of concrete driveways, curbs, gutters and sidewalks.

1.3 RELATED WORK

The following items of related work are specified and included in other sections of these specifications:

A. Section 02220 - Excavating, Backfilling and Compacting

B. Section 03300 – Concrete Work

1.4 SUBMITTALS

Concrete Design: Contractor shall be responsible for design of concrete mixes. An independent testing laboratory shall determine design mixes of each type concrete based on specified strengths and materials in accordance with ACI 318-89. Submit 4 copies of design mix for approval.

1.5 MOCK-UP

Construct sidewalk width by 5-foot-long mock-up, which may be incorporated into the work. Construct mock-up in time to allow evaluation of color and texture after setting.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C-150-78a, Type I or III.

B. Fine Aggregate: Natural Sand, ASTM C-33-78.

C. Coarse Aggregate: Hard, durable natural gravel or crushed rock meeting requirements of ASTM C-33-78. Maximum size and gradation in accordance with Size No. 67 or 467 in Table II of ASTM C-33.

D. Grading: ASTM C-136.

E. Water: Potable.

F. Admixture: Cement-dispersing, water reducing compound such as Pozzolith 100 series, as made by Master Builders. Air entraining agent meeting requirements of ASTM C260.

G. Reinforcing Steel: ASTM A615, grade 60.

H. Wire Mesh, ASTM A185.

I. Forms: Nominal 2" thickness dimension fir wood, 3/4" fir plywood, or steel paving forms.

J. Premolded Expansion Joint Filler: ASTM D-1782, non-asphaltic.

K. Dowels and Sleeves: 3/4" plain round bars, with plastic sleeve at one end, 24 inches long, allowing one inch of movement. Refer to drawings.

PART 3 EXECUTION

3.1 PREPARATION

A. Sawcut existing pavements and concrete to be joined by new construction to neat, vertical, true lines in such manner that adjoining surfaces will not be damaged. Clean cut asphalt pavement with approved equipment. Do not rip or root outside limits of cuts. Haul surfacing materials removed from the Project site to an approved offsite disposal area immediately. Do not use removed surfacing materials for backfill.

B. Excavate, backfill and compact subbase in accordance with related work.

C. Do not place excavated or displaced material on the base course or surface of the roadway. Do not deposit excavated materials where the material will interfere with access to property or traffic flow in street.

D. Sawcut and remove concrete driveways as required to provide the slopes indicated by the standard details.

E. Sawcut and remove concrete sidewalks as required to provide slopes within the specified limits.

3.2 FORMWORK AND REINFORCING

A. Construct concrete curbs, gutter and sidewalks with conventional forms, or with appropriate machines specifically designed for construction of concrete curbs, gutters and sidewalks when approved.

B. When machines designed specifically for such work and approved are used and results are not satisfactory, discontinue use of machine and make repairs. Apply applicable requirements of construction with use of forms to use of machines.

C. Carefully set forms conforming to dimensions of curb, gutter, sidewalk and driveway to line and grade, and securely stake forms in position. Oil forms and luster subgrade immediately prior to placing concrete.

D. Install ½ inch thick expansion joint filler strips with top edge 1/4 inch below projected concrete surface. Hold joint filler strips in place with steel pins or other devices to prevent warping or deflecting of filler during placing and finishing. Install expansion joints as noted in paragraph 3.3. Install the joints in straight lines and vertical planes perpendicular to longitudinal lines of sidewalks or curbs and gutters, or when in curved alignments, along radial lines. Install joints to full depth and width of concrete and matching joints in adjacent sidewalks or curb gutters. Install joints at P.C.'s and P.T.'s of curves, at intersection between driveways, sidewalks, and at eyes of adjoining structures.

E. Install reinforcement as required in the drawings.

F. Thoroughly clean forms after each use and coat forms with light oil, or other releasing agent which will not discolor concrete.

3.3 CONCRETE PLACEMENT AND FINISHING

A. Place concrete in accordance with related work.

B. Place concrete in one lift so when compacted and finished pavement will be of thickness indicated.

C. After placing concrete, strike-off surface with strike-off tool guided by side forms. Thoroughly spade concrete away from forms so that there is no rock pockets next to forms, or compact concrete with approved mechanical vibrators. Continue tamping or vibrating until mortar flushes to surface, and coarse aggregate is below surface.

D. Finish surface with wood float.

E. Divide surface into rectangular areas as indicated or at approximately 5 feet o.c. with scored ½ inch deep control joints. Score control joints with deep cutting scoring tool.

F. Control Joints: Strike control joints in straight lines and vertical planes perpendicular to longitudinal lines of sidewalks or curbs and gutters, or when in curved alignments, along radial lines of curbs.

G. Construction Joints: Stoppage of concrete placing shall occur at expansion joint or other detailed contraction joints. Construct bulkheads to permit continuation of reinforcing steel.

H. Expansion Joints: Place expansion joint fillers where detailed on drawings; where paving abuts existing paving, structure or walls; every 30 feet each way in

paving. Provide removable tacked-on strips to provide a recess for joint sealing compound. Provide expansion joints every 30 feet in curbs at walks. 3/4"

I. Dowels, 24" long shall be placed at 24" O.C. through expansion joints, sleeved one side, at all expansion joints except where joint abuts building, unless noted otherwise.

J. Saw-Cut Contraction Joints: Saw-cut joints when concrete is hard enough not to be torn, raveled, or damaged by saw cutting equipment and no later than 10 hours after concrete placement. Trial cuts shall be made prior to execution. Use a power drive concrete saw. Saw blades shall make a clean, smooth cut, producing a groove 1/8" to 1/4" wide to depth required (1/4 slab depth). Locate contraction joints nominally at 15'-0" O.C., unless specified otherwise on Drawings. All joints shall receive sealant.

K. Immediately after finishing, round edges of perimeter of forms and joint edges with edging tool having radius of 1/8 inch, and remove concrete from over joint fillers.

L. Completed surface shall be uniform in color and should be free of surface blemishes and tool marks.

M. Do not remove front face forms until concrete has initially set and has sufficient strength to carry its own weight. Do not remove gutter forms and rear forms until concrete has hardened sufficiently to prevent damage to edges. Exercise care to prevent damage. Repair or replace concrete damaged while stripping forms. Test faces, tops backs, and flow lines of curbs and gutters with ten foot straightedge or curve template, longitudinally along surfaces. Correct deviation in excess of 1/4 inch.

N. Finish concrete as follows:

1. Sidewalks: Light brown perpendicular to walk centerline.

2. Driveway: Medium broom perpendicular to driveway centerline.

3. Curb and Gutter: Fine hair brush parallel with curb.

O. Stamp name and year on work on each end of curb, gutter, or sidewalk in letters not less than 3/4 inch high.

Backfill behind curbs or sidewalks with soil native to area to lines and grades indicated.

3.4 INSTALLATION OF CONCRETE STRUCTURES

A. Place concrete on firm subgrade, free from water. Keep ground water several inches below subgrade until concrete has set. Moisten subgrade in dry earth with water from spray nozzles immediately before concrete is placed.

B. Place reinforcing steel and concrete immediately after placing filter or drain material. Keep filter or drain material dewatered to prevent concrete materials from being carried away before concrete has set.

C. Construct concrete formwork, reinforcement, concrete accessories and cast-in-place concrete in accordance with related work.

3.5 CURING

Cure concrete in accordance with related work.

3.6 TESTING OF SURFACES

A. Test surfaces of concrete sidewalks with 5 foot straightedge. Correct deviations in excess of 1/8 inch.

B. Water test gutters slopes of 0.8 foot per hundred feet or less, or where unusual or special conditions cast doubt on capability of gutters to drain. Establish flow in length of gutter to be tested by supplying water from hydrants, tank trucks or other source. One hour after water supply is shut off, inspect gutter for evidence of ponding or improper shape. Correct defects when water is found ponded in gutters or on adjacent asphalt pavement to 1/4 inch or greater, No ponding of any depth is allowed at the bottom of the handicapped ramps.

3.7 PROTECTION AND REPAIR

A. Protect concrete work from damage and vandalism. Repair damaged or vandalized concrete and clean discolored concrete.

B. When concrete cannot be repaired and must be removed, remove damaged concrete and replace concrete between expansion joints.

3.8 OPENING TO TRAFFIC

A. Obtain approval prior to opening pavement to traffic.

B. Close pavement to traffic for at least 7 full days or until minimum compressive strength of concrete is at least 75% of design strength.

C Restrict traffic to passenger cars and light trucks for at least 14 days after concrete is placed.

3.9 TESTING

A. Inspection and testing will be performed accordance with Division 1, General Requirements.

B. Provide free access to work and cooperate with appointed firm.

C. Tests of cement and aggregates may be performed to ensure conformance with Contract Documents.

D. Three concrete test cylinders will be taken for every 75 or less cu. yds. of each class of concrete placed. Make and cure concrete compressive strength test specimens in accordance with ASTM C31.

E. One additional test cylinder will be taken during cold weather and shall be cured on the Project site under same conditions as concrete it represents. Construct storage box of sufficient size and design to provide protection for cylinders stored on site.

F. One slump test will be taken in accordance with ASTM C143 for each set of compressive strength test cylinders taken.

G. Where concrete is placed by pumping, tests shall be taken at truck before concrete is placed in pump.

H. Testing laboratory will perform compressive strength tests in accordance with ASTM C39.

END OF SECTION

SECTION 02622

PVC PRESSURE PIPE AND FITTINGS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

This section shall include the furnishing and installation of PVC pressure pipe.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching and backfilling: Section 02223

1.3 QUALITY ASSURANCE

A. The pipe manufacturer shall be a member of the Plastic Pipe and Fittings Association or Uni-Bell PVC Pipe Association and shall have manufactured the pipe and/or joint proposed for use for not less than five (5) years.

B. The pipe shall be permanently marked by the manufacturer and coded for the date, batch and shift in which the pipe was made along with other required marking as set forth in ASTM or AWWA Standard Specifications. The pipe shall also bear the NSF seal.

C. The supplier shall furnish to the contractor a warranty governing both workmanship and material and shall be for a period of not less than one (1) year from date of acceptance by the Owner or his agent. The warranty of the material by the supplier shall be in writing to the contractor. Any material failure shall be replaced at no cost to the Owner.

D. All PVC water pipe shall be by the same manufacturer, unless otherwise approved by the Engineer.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPE

A. General - The pipe and fittings shall be manufactured from NSF approved Type I, Grade I PVC, which is Class 12454-B rigid PVC compound, conforming to ASTM

Resin Specifications D-1784 as amended and/or revised and shall be stamped with the NSF seal of approval and permanently marked.

B. Provisions shall be made for expansion and contraction at each joint by use of a gasket type joint and integral bell, or equal.

C. Size Four Inch and Larger - The pipe shall have a minimum pressure rating of 200 psi at 73.4° F and conform to the requirements of specifications ASTM D-2241-69, and Product Standards PS 22-70 as amended and/or revised, and with standard dimension ratio (SDR) of 21. Pipe with a pressure rating of 250 psi (SDR-17) or 315 psi (SDR-13.5) shall be installed at locations required by the plans. Also where called for by the plans, pipe meeting the requirements of AWWA C-900 Class 200, Class 150, Class 100 shall be installed.

D. Size Three-Inch and Smaller - The pipe shall have a minimum pressure rating of not less than 200 psi at 73.4° F and conform to the requirements of Specifications ASTM D-2241-69 and Product Standard PS 22-70 and with standard dimensions ratio (SDR) of 21. Pipe with a pressure rating of 250 psi (SDR-17) or 315 psi (SDR-13.5) shall be installed at locations required by the plans.

2.2 FITTINGS

A. Size Four Inch and Larger - All fittings and specials used in connection with pipe four-inch and larger shall conform to AWWA short or long bodied cast or ductile iron fittings using a mechanical joint system with hardened or duct tipped type of rubber gaskets in accordance with AWWA Specifications C-110 and C-111. The fittings shall be cement lined in accordance with AWWA Specification C-104. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and the Engineer or his representative.

B. Size Three-Inch and Smaller - All fittings and specials used in connection with pipe three-inch and smaller shall be rated at least equal to pressure class rating of the pipe and conform to recommendations by the pipe manufacturer or be of proven pipe. The pipe and fittings shall be installed in accordance with the recommendations of the pipe manufacturer and as directed by the Engineer. No PVC male adapters will be allowed.

2.3 LUBRICANTS

The joint lubricant shall be nontoxic, shall not support the growth of *bacteria* and shall have no deteriorating effects on the gasket and pipe materials. The lubricants shall comply with NSF Standards 14 and 61, ASTM D 3139 and shall not impart taste or odor to water in a pipe that has been flushed in accordance with AWWA C601-68.

PART 3 - EXECUTION

3.1 HANDLING AND LAYING PVC PLASTIC PIPE AND FITTINGS

Remove any dirt or foreign material from groove so that ring will set completely in the ring groove. The ring shall be faced in the prOPer direction with color marking faced out. Smooth ring so that it sets evenly all around in the groove free from any twists. Ring insertion on small pipe can be made easier by dipping ring in plain water (do not use lubricant on ring). Clean the entire circumference of the spigot end of the pipe and apply lubricant of the type recommended by the pipe manufacturer. The lubricant shall be applied from a point one inch back from the beveled end of the pipe with pad, sponge, or cloth. The thickness of the applied coat or lubricant shall be constant with a brush coat of enamel paint.

The bell of the pipe shall be held firmly in place to prevent the joints already assembled in the line from closing up. Insert the spigot end of the pipe in line with the bell and as straight as possible and shove in place to the preset reference mark. Assembly shall be made with the pipe as close to the ground as possible. The use of metal chains, cables, etc., for assembly will not be permitted. Any undue resistance during assembly indicates the ring may have become twisted and the joint shall be pulled apart and reassembled.

If it becomes necessary to cut pipe, a tubing cutter or carpenter's saw shall be used and cut shall be made perpendicular to the centerline of the pipe. Remove burrs from inside of wall by means of a knife or fine sandpaper. After cutting pipe and before jointing, the end shall be beveled to conform as near as possible to a factory bevel using a milled curved tooth flat file so as to get a smooth surface. No threading of pipe will be allowed. Use a pencil or crayon to make new reference mark using a factory mark as a pattern.

Minimum curves of pipe shall not be less than that recommended by the pipe manufacturer.

3.2 SETTING FITTINGS

Cast Iron and ductile iron fittings shall be set in the line as the work progresses and shall be connected to the water line as specified. Plugged fittings shall be carefully laid and properly blocked to avoid leakage. Where small service mains are to be connected at specials, the contractor shall use tapped plugs.

3.3 TESTING

A. General - After the water mains have been laid as specified, the entire system shall be given a hydrostatic pressure test and a leakage *test.* This may be done by sections between valves as selected by the Engineer for convenience.

These tests shall be performed by the contractor in the presence of the Engineer. The contractor shall furnish all necessary pressure gauges, meters, and pumps, and make all taps and connections.

B. Hydrostatic Test - The section to be tested shall be slowly filled with water and all air expelled. Pressure shall be applied by means of a pressure pump and maintained for at least two hours or until the whole section can be examined. The test shall be at 50% above normal operating pressure for the area, not to exceed the class rated pressure of the pipe; however, in no case shall the testing pressure be lower than 100 psi on any portion of the line being tested. All leaks and defects found during the test shall be satisfactorily repaired and corrected by the contractor.

C. Leakage Test - The contractor will make a leakage test, and the test shall be at the same pressure conditions as specified for the hydrostatic test. Each leakage test shall be of two hours duration or longer, if necessary, to satisfy the Engineer that leakage in the line meets the .

Allowable leakage (in GPH) is given by the formula:

L= (N D ^1/2)/7400

N = Number of Joints
D = Nominal diameter of pipe inches
P = Average test pressure in psi

If the leakage in the test section does not meet the specifications, the contractor shall locate and repair the leaks and retest the line. The cost of this work shall be included in the unit price for laying pipe and will not be paid for separately.

3.4 STERILIZATION

All mains shall be thoroughly flushed until all foreign material -and colored water is expelled before sterilization.

Before the mains are placed in service, they shall be Sterilized with chlorine. Either liquid chlorine or hypochlorite may be used in such amount as to provide a dosage of chlorine not less than 50 ppm. The sterilizing agent may be introduced in any manner, approved by the Engineer that will insure a uniform distribution.

Following a contact period of not less than 24 hours, the chlorine shall have a residual of not less than 25 ppm. The chlorinated water shall then be flushed from the line or structures and samples taken and analyzed for bacterial purity. This process shall be continued until samples indicate that the water is safe for human consumption as determined by the Arkansas Health Department. All valves in water lines being sterilized shall be opened and closed several times during the test period. Two consecutive daily samples are presently required by the Health Department for approval.

The contractor shall provide samples as directed by the Engineer for bacterial analysis and approval by the Arkansas Health Department. The cost of this work shall be included in the unit price for laying pipe and will not be paid for separately.

3.5 CONTRACTOR'S SUPPLIER LIST

At the time of the pre-construction conference, the contractor shall present to the Engineer and Owner a complete listing (by manufacturer) of all materials to be used on the project. I f required to do so, he will also furnish submittal information and other material needed to determine if the proposed material will meet these specifications.

END OF SECTION

SECTION 02669
POTABLE WATER SYSTEM

PART 1 GENERAL

1.1 PROVISIONS

I. Throughout the specifications, manufacturer's name and catalogue number may specify types of materials in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawing.

B. The Work described in this section of the specifications includes, but is not limited to the following:

1. Water line construction with necessary water main materials, fittings, connections and accessories.

1.3 RELATED WORK

The following items of related work are specified and included in other sections of these specifications:

1. Section 02220 - Excavating, Backfilling and Compacting.

1.4 CONSTRUCTION SCHEDULING AND COORDINATION

Service to water customers shall not be disrupted during installation of the water line improvements except for the time required to change individual services as specified herein.

The Contractor shall notify the City of Forrest City Utility Department at least 48 hours prior to scheduled connections of mains. Scheduling shall be subject to the approval of the Utility Department and the Engineer.

The work of this Section shall be coordinated with the work of other Sections.
The Contractor shall make field measurements at the site to verify or supplement indicated dimensions and to ensure proper coordination of all construction items.

The sequence of construction and change over shall be as follows:

A. Install new mains as shown on the plans, including fire hydrants in accordance with the specification shown in the plan.

B. Test, disinfect and sample mains as specified. After samples are approved, place mains in service.

C. Install new services, including saddles, and transfer customer's services to the new main.

D. On lines to be abandoned, close existing valves and cut and plug line; remove existing valve box and fire hydrants.

PART 2 PRODUCTS

2.1 PVC PIPE

A. All Polyvinyl chloride (PVC) pressure pipe shall conform to AWWA C 900 made from class 12454 - A or 12454-B material as defined by ASTM D1784 with classification specified in the drawing. PVC pipe shall have a minimum pressure class rating of 150 psi.

2.2 GATE VALVES AND BOXES

A. Gate valves 3" and smaller shall be iron body, bronze mounted, resilient seat or double disc, parallel seat "O" ring. Gates valves may be either mechanical or slip joint rubber gasket joint. Gate valves shall be Mueller or American Flow Control AWWA Standard or equal. All valves must operate to close in the same direction as described in "C" below.

B. Gate valves 4" and larger shall be resilient seat type iron body with modified wedge disc. Valve interior shall have an iron body with modified wedge disc. Valve interior shall have an epoxy coating. Gate valve may be either mechanical or slip joint rubber gasket joint. Gate valves shall be Mueller resilient seat gate valve or equal.

C. All gate valves shall be non-rising stem type with 2" square operating nuts. Gate valves shall open to the left (counterclockwise) and shall be 200 psi design. One operating wrench shall be provided to the Owner. All gate valves by one manufacturer.

D. Valve boxes shall consist of cast iron base and top section with cover which shall be marked "Water." The top section shall be adjustable for elevations and shall be set to allow equal movement above and below finished grade. The base shall be centered over the valve and below finished grade. The base shall be centered over the valve and shall rest on compacted backfill. The top of the base section shall be approximately on line with nut at top of valve stem, and the entire assembly shall be plumb. The boxes shall be two-piece screw type, Tyler #142-Q on 2" and 3" valves, #562-S on 4" and 6" valves, and #461-S on 8" through 12" valves, or approved equal. Valve boxes shall be made by an American manufacturer.

2.3 CORPORATION COCKS

Shall be suitable for use with plastic or copper water service and shall be similar or equal to Type F1000 as manufactured by Ford Meter Box Company, or H-15008 as manufactured by Mueller Corporation. All 'brass' service line fittings shall be of red brass containing 85% copper and 5% each of tin, lead, and zinc in accordance with ASTM B-62. Upon request by the Owner, the supplier shall certify in writing to the Engineer that the fittings supplied

meet the above specifications and those of AWWA C-800. All corporation cocks shall be designed to withstand working pressures of up to 250 psi.

2.4 MASTER METER VAULT

A. Concrete Vault - To be constructed by the contractor as per Drawings.

2.5 MASTER WATER METERS

A. The Contractor will coordinate with the City utility company and pay for the installation of water meter assembly as per City standards and specifications.

2.6 FIRE HYDRANTS

Three-way hydrants shall be 5-1/4" safety break flange design equal to Mueller Centurion Catalog No. A-423. Leads shall be of the same material as the mains. One safety flange repair kit (Mueller A-301) shall be furnished to the Owner.

2.7 TAPPING SLEEVES AND VALVES

The tapping sleeve shall be either of the following types acceptable to Utility Company:

A. Cast Iron - Tapping sleeves shall be of cast iron material with mechanical joint type seals and shall be of split gland type designed for 150 psi working main pressure. The sleeves shall have a Class 125 outlet flange and be similar and equal to Mueller H-615.

B. Stainless Steel - Tapping sleeves shall be of stainless steel material of the split gland type designed for 150 psi working main pressure. The sleeve shall be similar and equal to Ford "SST."

C. Carbon Steel - Tapping sleeves shall be of ASTM 285 Grade C carbon steel with corrosion resistant bolts. The body of the fitting shall be coated with a fusion applied epoxy coating. The sleeve shall be similar and equal to JCM 412.

The tapping valve shall have a Class 125 inlet flange, be rated for 150 psi working pressure, and have a mechanical joint outlet. The valve shall be a gate valve meeting latest revision of AWWA Standard C500.

2.8 LOCATOR TAPE

3" wide MAGNA - TEC or approved equal

PART 3 EXECUTION

3.1 LAYING OF WATER PIPE AND FITTINGS

A. Pipe and accessories shall be handled in such a manner as to insure delivery on the work in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. Cutting the pipe for closure pieces or for other reasons shall be done by means of mechanical cutters of an approved type. Wheeled cutters shall be used where practicable.

B. Before lowering into trench, and while suspended, the pipe shall be inspected for defects and cracks. Any defective, damaged, or unsound pipe shall be rejected. Deflections from a straight line or grade, made necessary by vertical or horizontal curves or offsets, shall not exceed the maximum recommended by the pipe manufacturer. Where these maximum deficiencies would otherwise be exceeded, the contractor shall provide special bends as approved by the Engineer, or a sufficient number of shorter lengths of pipe to provide angular deflections within the limits set out above. Except where otherwise necessary, pipe shall be laid with the bells facing in the direction of laying.

C. All fittings at bends in the pipe shall be firmly wedged against the vertical face of the trench, or have suitable thrust backing as required by the Engineer. Reaction of thrust bearing shall be of concrete, placed between solid ground and the fitting.

3.2 TESTING

A. General - After the water mains have been laid as specified, the entire system shall be given a hydrostatic pressure test and a leakage test. This may be done by sections between valves as selected by the Engineer for convenience. These tests shall be performed by the contractor in the presence of the Engineer. The contractor shall furnish all necessary pressure gauges, meters, and pumps, and make all taps and connections.

B. Hydrostatic Test - The section to be tested shall be slowly filled with water and all air expelled. Pressure shall be applied by means of a pressure pump and maintained for at least two hours or until the whole section can be examined. The test shall be at 50% above normal operating pressure for the area, not to exceed the class rated pressure of the pipe; however, in no case shall the testing pressure be lower than 100 psi on any portion of the line being tested. All leaks and defects found during the test shall be satisfactorily repaired and corrected by the contractor. The contractor shall provide the water for testing.

C. Leakage Test - The contractor will make a leakage test, and the test shall be at the same pressure conditions as specified for the hydrostatic test. Each leakage test shall be of two hours duration or longer, if necessary, to satisfy the Engineer that leakage in the line meets the specifications.

Allowable leakage (in GPH) is given by the formula:

$$W_h = \frac{N\ D\sqrt{P}}{7{,}400}$$

where:

N = Number of Joints
D = Nominal diameter of pipe in inches
P = Average test pressure in psi

If the leakage in the test section does not meet the specifications, the contractor shall locate and repair the leaks and retest the line. The cost of this work shall be included in the unit price for laying pipe and will not be paid for separately.

3.3 STERILIZATION

All mains shall be thoroughly flushed until all foreign material and colored water is expelled before sterilization.

Before the mains are placed in service, they shall be sterilized with chlorine. Either liquid chlorine or hypochlorite may be used in such amount as to provide a dosage of chlorine not less than 50 ppm. The sterilizing agent may be introduced in any manner, approved by the Engineer, that will insure a uniform distribution. Following a contact period of not less than 24 hours, the chlorine shall have a residual of not less than 25 ppm. The chlorinated water shall then be flushed from the line or structures and samples taken and analyzed for bacterial purity. This process shall be continued until samples indicate that the water is safe for human consumption as determined by the Arkansas Health Department. All valves in water lines being sterilized shall be opened and closed several times during the test period. Two consecutive daily samples are presently required by the Health Department for approval.

The contractor shall provide samples as directed by the Engineer for bacterial analysis and approval by the Arkansas Health Department. The cost of this work shall be included in the unit price for laying pipe and will not be paid for separately.

3.4 SETTING VALVES

Valves shall be placed in the line at points designated on the drawings. Valves shall be placed with the stem vertical. Valve boxes shall be placed with the top of the finished grade of the street.

3.5 INSTALLATION OF SERVICE CONNECTION

Service connection shall be made in accordance with details shown on the plans. The service line shall be laid perpendicular to the main line where possible. The contractor is responsible to connect the building shown on the drawings to the main water main. This task shall only take place after, testing and sterilizing of the main and service lines.

3.6 SETTING FIRE HYDRANTS

All fire hydrants shall have a minimum bury of 3 feet, and shall be installed as shown on the plans.

END OF SECTION

SECTION 02730

SANITARY SEWAGE SYSTEM

PART 1 GENERAL

1.1 PROVISIONS

A. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION

A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawing.

B. The Work described in this section of the specifications includes, but is not limited to, the following:

1. Relocate sewer service to backwash pit.

1.3 RELATED WORK

A. The following items of related work are specified and included in other sections of these specifications:

1. Section 02220 - Excavating, Backfilling and Compacting.

PART 2 PRODUCTS

2.1 SANITARY SEWER MAIN

The pipe for the gravity sewer shall be PVC SDR 35 sewer pipe, ASTM Specification D3034(PSM), made from plastic having cell classification of 12454-B as defined in ASTM D1784. All wyes, tees, and bends shall be manufactured of the same material as the sewer pipe used and all wyes or ends of service shall be equipped with a watertight plug. All sewer pipe shall be installed using either Class I embedment materials.

2.2 SANITARY SEWER SERVICE

4" PVC SDR 35 sewer pipe as specified above shall be used for service gravity sewer. Maintain minimum slope of 1% for all service lines.

PART 3 EXECUTION

3.1 GENERAL

All equipment necessary and required for the proper construction of the sanitary sewers shall be on the project in first class working condition. The contractor shall provide the necessary hand tampers and pneumatic tampers to obtain the compaction of the pipe bed and backfill as specified. In order to comply with the requirements of the Arkansas State Health Department, the contractor shall maintain a minimum of ten (10) feet of horizontal separation between water and sewer lines when they are installed parallel and a vertical separation of 18" (minimum) when these lines cross.

Backfilling operations shall not lag more than 500 feet behind laying operations unless written authorization to do otherwise is given by the Engineer. The contractor shall mark all trenches left open at the end of the working day with appropriate barriers, lights, and signs as required by the various safety codes.

3.2 EXCAVATION

A. The Contractor shall do all excavation to the depth shown on the plans. Common excavation shall include all excavation including such rock as may be encountered in the trench. If the soil at the bottom of the trench is mucky, or in such condition that it cannot be properly shaped and graded, or if this material is too soft to properly support the bedding material, the contractor shall excavate below the normal subgrade elevation as directed by the Engineer. Whenever excavation is carried below the subgrade, at the direction of the Engineer, the contractor shall provide and install a foundation material of gravel or crushed stone thoroughly tamped into place up to an elevation sufficient to prepare the bedding as specified. A minimum of 6 inches of such foundation material will be required.

B. Where rock excavation is encountered in trench, the contractor shall excavate to the depth shown on the plans plus at least six inches (6"). A bedding material of at least six (6") inches shall be placed between the rock and the bottom of the pipe. This bedding shall consist of ballast, concrete aggregate or other acceptable graded or crushed stone material as shown on the plans. The depth of cut shown on the plans is from the surface of the ground to the invert of the pipe. The width of the trench at the top of the pipe shall be the outside diameter of the pipe bells plus twelve inches, minimum, and plus sixteen inches maximum. The bed for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the top of the bedding. The contractor shall do all bracing, sheathing, and shoring necessary to perform and protect all excavations required to prepare trenches for laying and installing pipe, and other structures incidental to the construction of this sewer system.

3.3 LAYING AND INSTALLING PIPE

The contractor shall provide a laser beam type grade light to insure the pipe is laid to the lines and grade shown on the plans. The Engineer shall inspect all pipe before it is laid and reject any pipe damaged or defective. Laying of pipe shall be started at the lowest

point and be laid up grade. The pipe shall be protected from water during placing and until joints are made.

3.4 BACKFILLING

All trenches and excavation s shall be backfilled in a reasonable time after the pipe is installed and bedded. Backfill material shall be shown on the standard detail drawings. Select backfill material containing stones or rock exceeding three inches (3") in diameter shall not be used adjacent to the pipe or until the fill over the pipe exceeds one foot (1') in common excavation and two feet (2') in rock excavation. No haunching or initial backfill material may be dropped from a height exceeding two feet (2') over the top of the pipe. Compaction of the bedding, haunching, and initial backfill material shall be obtained by hand tamping method until cover exists over the pipe as shown on the standard trench detail drawings. General backfill material containing large clods or stones larger than six inches (6") in diameter shall not be placed in trenches. In trenches located in paved streets, the general backfill shall be made in layers not to exceed six inches (6") and shall be compacted to a density of 95% Modified Proctor by pneumatic tampers or other equipment approved by the Engineer in such manner that minimal settling of the trench will occur. The contractor will top the backfill by placing the stone or gravel base material level with the existing surface. The crossing shall then be opened to traffic for a period of at least three weeks before the finished surface is placed. Where sufficient backfill material is not available for any of the above operations, it shall be hauled to the work site by the contractor.

3.7 TESTING OF GRAVITY SEWERS AND MANHOLES

Mandrel deflection testing is required for gravity sewer lines. Deflection shall not exceed 5 percent. Tests for water tightness shall be made on each section of sewer line by the contractor in the presence of the Engineer or his authorized representative by one of the following methods:

A. Exterior Saturated Ground Water Pressure - Infiltration due to exterior ground water pressure shall not exceed 50 gallons per mile per inch diameter per day. The contractor shall furnish all equipment necessary for the completion of this test. If dependable results cannot be achieved due to a low ground water table, the low pressure air loss method shall be used. This method (the E.S.G.W.P.) shall be used only when the ground water table is over the top of the sewer pipe.

B. Low Pressure Air Loss - for testing the water tightness of sewer lines. The contractor shall furnish all equipment necessary for this test. The test shall be conducted following procedures outlined. Air pressure in the lines shall not exceed 5.0 psig. An internal pressure of 3.5 psig minimum shall be maintained for at least 5 minutes. After the stabilization period, the time required for a pressure loss of 0.5 psig (3.5 psig to 3.0 psig) will be recorded. If the time for this pressure loss is greater than that shown in the table below, the section undergoing the test shall have passed.

END OF SECTION

SECTION 02741
HOT-MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1. 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASIITO)

AASHTO M 17	(1994) Mineral Filler for Bituminous Paving Mixtures
AASHTO M 20	(1994) Penetration Graded Asphalt Cement
AASHTO M 226	(1994) Viscosity Graded Asphalt Cement
AASHTO T 11	(1994) Materials Finer Than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T 27	(1994) Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 30	(1994) Mechanical Analysis of Extracted Aggregate
AASHTO T 164	(1994) Quantitative Extraction of Bitumen From Bituminous Paving Mixtures
AASHTO T 166	(1994) Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface -Dry Specimens

ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT (AHTD)

Standard Specifications for Highway Construction (2003 Edition)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method

1.2 MEASUREMENT AND PAYMENT

Subsections 407.05 and 407.06 of the AHTD Standard Specifications for Highway Construction are not applicable.

1.3 STANDARD SPECIFICATIONS

Asphaltic concrete hot mix surface course shall conform to the provisions of Section 407

- Asphalt Concrete Hot Mix Surface Course, Section 409. Materials and Equipment for Asphalt Concrete Hot Mix Binder and Surface Courses, and Section 410 - Construction Requirements for Asphalt Concrete Hot Mix Binder and Surface Courses of the Arkansas State Highway and Transportation Department “Standard Specifications for Highway Construction”, except as specified herein. Reference hereinafter to the Arkansas State Highway and Transportation Department “Standard Specifications for Highway Construction” will be by the basic designation “Standard Specifications”. The words “Chief Engineer” or “Engineer” in the Standard Specifications shall be interpreted to mean “Contracting Officer”. In case of conflict between the Standard Specifications and this specification, this specification shall govern. Copies of the Standard Specifications may be obtained from the Arkansas State Highway and Transportation Department, Little Rock, Arkansas, for $8 per copy.

1.4 SUBMITTALS

Government approval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. When used, a designation following the “G” designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

SD-O3 Product Data

Physical Characteristics of Asphalt Cement.

The specific physical characteristics of the asphalt cement grade proposed shall be submitted to the Contracting Officer for approval.

SD-07 Certificates

Mix Designs (Contractor and Job).

The Contractor shall submit the job mix formula for asphaltic concrete to the Contracting Officer for approval.

The Contractor shall furnish certificates of compliance with the requirements of penetration grade 60-70 asphalt cement in Table 1 of AASHTO M 20 for each lot of asphalt cement used in the production of asphalt mixture used in this contract. If the Contractor furnishes the viscosity-graded asphalt cement as permitted in paragraph: Asphalt Cement, he shall submit certificates of compliance for that material.

1.5 EQUIPMENT

1.5.1 General Requirements

Batching plant, rollers and mechanical spreading and finishing equipment shall be as specified in Subsections 409.03 through 409.05 of the Standard Specifications. The pavement lay-down machine shall be equipped with an automatic screed control.

1.5.2 Scales

Scales shall be standard truck scales of the beam type and of sufficient size and capacity to accommodate all trucks to be used by the Contractor in handling

bituminous mixtures. Scales shall be tested and approved by an inspector of the State Inspection Bureau, charged with scale inspection within the State in which the project is located. If such testing by an inspection bureau is not available, the scales will be tested by the Contractor in the presence of the Contracting Officer. The necessary number of standard weights for testing the scales shall be on hand at all times. Scales shall meet the minimum requirements of the State Inspection Bureau.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Mineral Aggregate

Mineral aggregate shall be as specified in Sections 407 and 409 of the Standard Specifications for asphaltic concrete hot mix surface course, except as specified herein.

2.1.2 Asphalt Cement

The asphalt cement shall be as specified for penetration grade 60-70 in Table 1 of AASHTO M 20. The Contractor may furnish a viscosity graded asphalt cement. The viscosity graded asphalt cement furnished shall be in accordance with AASHTO M 226 as revised herein. Specific physical requirements to be met are those set forth in Table II of AASHTO M 226 with the following added grade.

TEST	VISCOSITY GRADE AC-30
	Viscosity, 60C (140F), poises 3000± 600
Viscosity, 135C (274F), cs-minimum	350
Penetration, 25c (77F), lOOg, 5 sec. -minimum	55
Flash Point, COC, C(F)-minimum	450
Solubi1ity in trihloroethylene. Percent-minimum	99.0
Tests on Residue from Thin-Film Oven Test:	
Loss on heating, percent—maximum	0.5
Viscosity, 60C (140F), poises-maximum	12,000
Ductility, 25C (77F), 5 cm/mm., cm-minimum	100
Spot Test	Negative

Change the requirement on Ductility for Grades AC-lO, AC-20, and AC-40 to 40 inch minimum.

If required, the asphalt cement shall contain a heat-stable anti-stripping additive. The additive shall be one approved by the Contracting Officer. It shall be added at the rate specified by the Contracting Officer as determined by laboratory analysis, depending on the brand name, concentration of the additive and laboratory mix design. The anti-stripping additive shall be added either to the supply fill line as the tanker is filled at the refinery or at the hot mix plant in a method approved by the Contracting Officer. In either case, the additive shall be thoroughly mixed with the asphalt cement. The anti-stripping

additive will not be paid for directly, but will be considered subsidiary to the item of asphalt cement.

2.2 JOB MIX MATERIALS

2.2.1 Approved Source

If the paving material is to be furnished from an existing plant that has been furnishing material meeting the requirements of Section 407 of the Standard Specifications for work for the Arkansas State Highway and Transportation Department, the state-approved job mix formula for Type 2 Asphaltic Concrete Hot Mix Surface Course may be used. This job mix formula shall be submitted to the Contracting Officer for approval.

2.2.2 New Source

If the paving material is to be furnished from a new plant, or an existing plant that has not been furnishing material meeting requirements of Section 407 of the Standard Specifications for work for the Arkansas State Highway and Transportation Department, the job-mix formula shall be designed by the Contractor and furnished to the Contracting Officer for approval prior to use. The job-mix formula will meet the requirements of the Standard Specifications.

PART 3 EXECUTION

3. 1 APPLICATION OF ASPHALTIC CONCRETE SURFACE COURSE

Type 2 asphaltic concrete surface course shall be laid to the typical section or sections indicated on the drawings or specified for the particular road and in accordance with Section 410 of the Standard Specifications or as otherwise specified herein.

3.1.1 Automatic Screed Control

The automatic screed control system shall be used for laying sections of roadway but will not be required on parking areas, camping turnouts, intersections, short loops, or non-typical width sections of roadways.

3.1.2 Establishment of Rolling Pattern

The Contractor shall establish a rolling pattern that will produce the required density at the beginning of pavement operations. The Contractor shall lay a strip of the required pavement, not to exceed 100 feet in length, and use a nuclear density gauge to determine the number of roller coverages necessary to achieve the required density. No further paving shall be performed until an acceptable rolling pattern is established. If the density achieved is unacceptable, then the compaction method or equipment shall be changed and a new rolling pattern established. Also, a new rolling pattern shall be established after any change in the job mix. Final acceptance of the pavement will be based on density tests on samples taken from the finished pavement.

3.2 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by a commercial testing

laboratory approved by the Contracting Officer or may be performed by the Contractor when approved in writing by the Contracting Officer. Tests to be performed shall be as specified or as otherwise specified by the Contracting Officer.

3.2.1 Density of Pavement
One sample for density determination shall be sawed or cored from the finished pavement for each 200 tons or less of bituminous mix placed each day of this contract and tested in accordance with AASHTO T166. Sample locations shall be selected by the Contracting Officer. Additional samples and testing may be required if any sample fails to meet density requirements.

3.2.2 Fine and Coarse Aggregates
Fine and coarse aggregates shall be tested once for each day of operation in accordance with AASHTO T1l, T27, and 30, as applicable.

3.2.3 Mineral Filler for Bituminous Paving Mixtures
Mineral filler shall be tested once for each day of operation in accordance with AASHTO Ml7.

3.2.4 Extraction Tests on Bituminous Mixtures
One extraction test on the paving mixture shall be made in accordance with AASHTO T 164 for each day of operation.

3.2.5 Thickness Check Tests
Thickness check tests shall be performed every 50 lineal feet of asphalt roadway using a straightedge and ruler.

END OF SECTION

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

1. 1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D 789	(1998) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D 3405	(1997) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

1.2 SUBMITTALS

Engineer's approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTALS:

SD-03 Product Data

Materials List; G
List of all materials required and the manufacture's data for each material listed 30 days prior to use on the project.

Manufacturer's Recommendations; G
Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 30 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

Construction Equipment List; G
List of proposed equipment to be used in performance of construction work including descriptive data, 45 days prior to use on the project.

SD-04 Samples

Materials; G
Samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval 30 days prior to the beginning of work. No material will be allowed to be used until it has been approved.

1.3 TEST REQUIREMENTS

The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. Testing of the materials shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted and approved 30 days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

1.4 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.4.1 Joint Cleaning Equipment

1.4.1.1 Tractor-Mounted Routing Tool

The routing tool used for removing old sealant from the joints shall be of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

1.4.1.2 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades will be provided for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not .provide a clean joint.

1.4.1.3 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 6.4 mm. The air compressor shall be portable and shall be capable of furnishing not less than 71 liters per second and maintaining a line pressure of not less than 621 kPa at the nozzle while in use. Compressor capability under job conditions must be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

1.4.1.4 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle~ and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjustable as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

1.4.1.5 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

1.4.2 Sealing Equipment

1.4.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing ASTM D 3405 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

1.5 TRIAL JOINT SEALANT INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section of at least 60 m long shall be prepared using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the test section and before any other joint is sealed, the test section shall be inspected to determine that the materials and installation meet the requirements specified. If it is determined that the materials or installation do not meet the requirements, the materials shall be removed, and the joints shall be recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. All other joints shall be prepared and sealed in the manner approved for sealing the test section.

1.6 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.7 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 10 degrees C and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing cracks in the paved areas indicated on the drawings shall be as follows: ASTM D 3405 AND COE CRD-C 525

2.2 PRIMERS

Primers, when their use is recommended by the manufacturer of the sealant, shall be as recommended by the manufacturer of the sealant.

2.3 BACKUP MATERIALS

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive—backed tape. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 3 mm wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

3.1.1 Existing Sealant Removal

The in-place sealant shall be cut loose from both joint faces and to the depth shown on the drawings, using the concrete saw as specified in paragraph EQUIPMENT. Depth shall be sufficient to accommodate any separating or backup material that is required to maintain the depth of new sealant to be installed. Prior to further cleaning operations, all loose old sealant remaining in the joint opening shall be removed by blowing with compressed air. Hand tools may be required to remove sealant from random cracks. Chipping, spalling, or otherwise damaging the concrete will not be allowed.

3.1.2 Facing of Joints

Facing of joints shall be accomplished using a concrete saw as specified in paragraph EQUIPMENT The blade shall be stiffened with a sufficient number of suitable dummy (used) blades or washers. Immediately following the sawing operation, the joint opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

3.1.3 Refacing of Random Cracks

Sawing of the cracks shall be accomplished using a power-driven concrete saw as specified in paragraph EQUIPMENT. The saw blade shall be 152 mm or less in diameter to enable the saw to follow the trace of the crack. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the crack opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

3.1.4 Sandblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 13 mm from the joint edges shall be sandblasted clean. A multiple-pass technique shall be used until the surfaces are

free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

3.1.5 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.8 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

3.1.7 Rate of Progress of Joint Preparation

The stages of joint preparation, which include sand blasting, air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D 3405 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day’s operation shall be withdrawn and wasted.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately proceeding, but not more than 15 m ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 3 mm plus or minus 1.5 mm below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. Then a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer’s instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirement5~ proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

END OF SECTION

SECTION 02763
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 247	(2005) Glass Beads Used in Traffic Paints

ASTM INTERNATIONAL (ASTM)

ASTM D 4280	(2004) Extended Life Type, Nonplowable, Raised, Retroreflective Pavement Markers
ASTM D 4505	(2005) Preformed Retroflective Pavement Marking Tape for Extended Service Life
ASTM D 792	(2000) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM E 28	(2004) Softening Point of Resins Derived from Naval Stores by Ring and Ball Apparatus

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325(Rev C)	Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952(Rev D)	Paint, Traffic and Airfield Markings, Waterborne

1.2 UNIT PRICES

1.2.1 Measurement

1.2.1.1 Surface Preparation

The unit of measurement for surface preparation will be the number of square meters feet of pavement surface prepared for marking and accepted by the Contracting Officer.

1.2.1.2 Pavement Striping and Markings

The unit of measurement for pavement striping and markings will be the number of square meters feet of reflective and nonreflective striping or marking actually completed and accepted by the Contracting Officer.

1.2.1.3 Raised Pavement Markers

The unit of measurement for raised pavement markers will be the number of square meters feet of each specific color required. Payment will be for the total number actually placed and approved by the Contracting Officer.

1.2.1.4 Removal of Pavement Markings

The unit of measurement for removal of pavement markings shall be the number of square meters feet of pavement markings actually removed and accepted by the Contracting Officer.

1.2.2 Payment

The quantities of surface preparation, pavement striping or markings, raised pavement markers, and removal of pavement markings determined as specified in paragraph Measurement, will be paid for at the contract unit price. The payment will constitute full compensation for furnishing all labor, materials, tools, equipment, appliances, and doing all work involved in marking pavements. Any striping or markings which are placed without reflective media, when reflective media is required, shall be removed and replaced at no cost to the Government. Striping or markings which do not conform to the alignment and/or location required shall be removed and replaced at no cost to the Government.

1.3 SUBMITTALS

Engineer’s approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval information only. The following shall be submitted in accordance with Section 01300 SUBMITTALS:

SD-03 Product Data

Equipment; [G]

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

Composition Requirements

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Qualifications

Documentation on personnel qualifications, as specified.

SD-06 Test Reports

Sampling and Testing

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-07 Certificates

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

1.4 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.5 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.5.1 Paint Application Equipment

1.5.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 8 km/hour 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. [Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified.] [The equipment used to apply the paint binder to airfield pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with an arrangement of atomizing nozzles capable of applying a line width at any one time in multiples of 150 mm 6 inches, from 150 mm 6 inches to 900 mm 36 inches]. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.5.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks

and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.5.2 Thermoplastic Application Equipment

1.5.2.1 Thermoplastic Material

Thermoplastic material shall be applied to the primed pavement surface by spray techniques or by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material. By either method, the markings shall be applied with equipment that is capable of providing continuous uniformity in the dimensions of the stripe.

1.5.2.2 Application Equipment

a. Application equipment shall provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe or spray gun shall prevent accumulation and clogging. All parts of the equipment which come into contact with the material shall be easily accessible and exposable for cleaning and maintenance. All mixing and conveying parts up to and including the extrusion shoes and spray guns shall maintain the material at the required temperature with heat-transfer oil or electrical-element-controlled heat.

b. The application equipment shall be constructed to ensure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off stripe ends squarely and shall provide a method of applying "skiplines". The equipment shall be capable of applying varying widths of traffic markings.

c. The applicator shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow. The bead dispenser shall be automatically operated and shall begin flow prior to the flow of composition to assure that the strip is fully reflectorized.

1.5.2.3 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. The equipment used for the placement of thermoplastic pavement markings shall be of two general types: mobile applicator and portable applicator.

a. Mobile Application Equipment: The mobile applicator shall be defined as a truck-mounted, self-contained pavement marking machine that is capable of hot applying thermoplastic by either the extrusion or spray method. The unit shall be equipped to apply the thermoplastic marking

material at temperatures exceeding 190 degrees C 375 degrees F, at widths varying from 75 to 300 mm 3 to 12 inches and in thicknesses varying from 1.0 to 5.0 mm 0.020 to 0.190 inch and shall have an automatic drop-on bead system. The mobile unit shall be capable of operating continuously and of installing a minimum of 6 km 20,000 lineal feet of longitudinal markings in an 8-hour day.

(1) The mobile unit shall be equipped with a melting kettle which holds a minimum of 2.7 metric tons 6000 pounds of molten thermoplastic material. The kettle shall be capable of heating the thermoplastic composition to temperatures of 195 to 220 degrees C 375 to 425 degrees F. A thermostatically controlled heat transfer liquid shall be used. Heating of the composition by direct flame will not be allowed. Oil and material temperature gauges shall be visible at both ends of the kettle. [The mobile unit shall be equipped with a minimum of two extrusion shoes located one on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. Each extrusion shoe shall be a closed, oil-jacketed unit; shall hold the molten thermoplastic at a temperature of 195 to 220 degrees C 375 to 425 degrees F; and shall be capable of extruding a line of 75 to 200 mm 3 to 8 inches in width; and at a thickness of not less than 3 mm 0.125 inch nor more than 5.0 mm 0.190 inch, and of generally uniform cross section.] [The mobile unit shall be equipped with a spray gun system. The spray system shall consist of a minimum of four spray guns, located two on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. The spray system shall be surrounded (jacketed) with heating oil to maintain the molten thermoplastic at a temperature of 195 to 220 degrees C 375 to 425 degrees F; and shall be capable of spraying a stripe of 75 to 300 mm 3 to 12 inches in width, and in thicknesses varying from 1.5 mm 0.055 inch to 2.5 mm 0.095 inch, and of generally uniform cross section.]

(2) The mobile unit shall be equipped with an electronic programmable line pattern control system. The control system shall be capable of applying skip or solid lines in any sequence, through any and all of the extrusion shoes, or the spray guns, and in programmable cycle lengths. In addition, the mobile unit shall be equipped with an automatic counting mechanism capable of recording the number of lineal meters feet of thermoplastic markings applied to the pavement surface with an accuracy of 0.5 percent.

b. Portable Application Equipment: The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines. The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. The portable applicator shall be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. The portable applicator shall be equipped with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 195 to 220 degrees C 375 to 425 degrees F, of extruding a line of 75 to 300 mm 3 to 12 inches in width, and in thicknesses of not less than 3.0 mm 0.125 inch nor more than 5.0 mm 0.190 inch and of generally uniform cross section.

1.5.3 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow

of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

1.5.4 Preformed Tape Application Equipment

Mechanical application equipment shall be used for the placement of preformed marking tape. Mechanical application equipment shall be defined as a mobile pavement marking machine specifically designed for use in applying precoated, pressure-sensitive pavement marking tape of varying widths, up to 300 mm 12 inches. The applicator shall be equipped with rollers, or other suitable compactive device, to provide initial adhesion of the preformed, pressure-sensitive marking tape with the pavement surface. Additional hand-operated rollers shall be used as required to properly seat the thermoplastic tape.

1.5.5 Surface Preparation Equipment

1.5.5.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 70.8 L/sec 150 cfm of air at a pressure of not less than 620 kPa 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.5.5.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa 2600 psi at 60 degrees C 140 degrees F in order to adequately clean the surfaces to be marked.

1.5.6 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.5.6.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.5.6.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradeable residue.

1.5.7 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

1.6 MAINTENANCE OF TRAFFIC

1.6.1 Airfield

The performance of work in the controlled zones of airfields shall be coordinated with the Contracting Officer and with the Flight Operations Officer. Verbal communications shall be maintained with the control tower before and during work in the controlled zones of the airfield. The control tower shall be advised when the work is completed. A radio for this purpose [will be provided by the Government] [shall be provided by the Contractor and approved by the Contracting Officer].

1.6.2 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.7 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 5 degrees C 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

1.8 QUALIFICATIONS

The Contractor shall submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of chemicals.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, parking areas, and streets shall conform to FS TT-P-1952, color as [indicated] [selected]. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

2.2 THERMOPLASTIC COMPOUNDS

The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed pavement surface. Following a surface application of glass beads

and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

2.2.1 Composition Requirements

The binder component shall be formulated as a hydrocarbon resin. The pigment, beads and filler shall be uniformly dispersed in the binder resin. The thermoplastic composition shall be free from all skins, dirt, and foreign objects and shall comply with the following requirements:

	Percent by Weight	
Component	White	Yellow
Binder	17 min.	17 min.
Titanium dioxide	10 min.	-
Glass beads,	20 min.	20 min.
Calcium carbonate & inert fillers	49 max.	*
Yellow pigments	-	*

*Amount and type of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing the other composition requirements of this specification are met.

2.2.2 Physical Properties

2.2.2.1 Color

The color shall be as indicated.

2.2.2.2 Drying Time

When installed at 20 degrees C 70 degrees F and in thicknesses between 3 and 5 mm 1/8 and 3/16 inch, after curing 15 minutes.

2.2.2.3 Softening Point

The composition shall have a softening point of not less than 90 degrees C 194 degrees F when tested in accordance with ASTM E 28.

2.2.2.4 Specific Gravity

The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with ASTM D 792.

2.2.3 Asphalt Concrete Primer

The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved and/or dispersed in a volatile organic compound (VOC). Solids content shall not be less than 10 percent by weight at 20 degrees C 70 degrees F and 60 percent relative humidity. A wet film thickness of 0.10 mm 0.005 inch plus or minus 0.025 mm 0.001 inch, shall dry to a tack-free condition in less than 5 minutes.

2.2.4 Portland Cement Concrete Primer

The primer for Portland cement concrete pavements shall be an epoxy resin primer. The primer shall be of the type recommended by the manufacturer of the thermoplastic composition. Epoxy primers recommended by the manufacturer shall be approved by the Contracting Officer prior to use. Requests for approval shall be accompanied with technical data, instructions for use, and a 1 liter 1 quart sample of the primer material.

2.3 PREFORMED TAPE

The preformed tape shall be an adherent reflectorized strip in accordance with ASTM D 4505 Type I or IV, Class optional.

2.4 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. [Materials will be sampled and tested by the Government. No material shall be used at the project prior to receipt by the Contractor of written notice that the materials meet the laboratory requirements. The cost of initial testing of samples from each lot of materials will be borne by the Government. If the sample fails to meet specification requirements, the material represented by the sample shall be replaced and the new material will be tested. Cost of sampling and testing the new material will be borne by the Contractor.] [Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.]

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or

mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C 40 degrees F and less than 35 degrees C 95 degrees F. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified . The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 2.9 plus or minus 0.5 square meter/L 105 plus or minus 5 square feet/gallon. Glass spheres shall be applied uniformly to the wet paint [on airfield pavement at a rate of 1.0 8] [on road and street pavement at a rate of 0.7 6] plus or minus 0.06 kg 0.5 pounds of glass spheres per L gallon of paint.

b. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 2.9 plus or minus 0.5 square meter/L 105 plus or minus 5 square feet/gallon.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Thermoplastic Compounds

Thermoplastic pavement markings shall be placed upon dry pavement; surface dry only will not be considered an acceptable condition. At the time of installation, the pavement surface temperature shall be a minimum of 5 degrees C 40 degrees F and rising. Thermoplastics, as placed, shall be free from dirt or tint.

3.2.2.1 Longitudinal Markings

All centerline, skipline, edgeline, and other longitudinal type markings shall be applied with a mobile applicator. All special markings, crosswalks, stop bars, legends, arrows, and similar patterns shall be placed with a portable applicator, using the extrusion method.

3.2.2.2 Primer

After surface preparation has been completed the asphalt and/or concrete pavement surface shall be primed. The primer shall be applied with spray equipment. Primer materials shall be allowed to "set-up" prior to applying the thermoplastic composition. The asphalt concrete primer shall be allowed to dry to a tack-free condition, usually occurring in less than 10 minutes. The

Portland cement concrete primer shall be allowed to dry in accordance with the thermoplastic manufacturer's recommendations. To shorten the curing time of the epoxy resins an infrared heating device may be used on the concrete primer.

a. Asphalt Concrete Primer: Primer shall be applied to all asphalt concrete pavements at a wet film thickness of 0.10 mm 0.005 inch, plus or minus 0.025 mm 0.001 inch (25-40 square meters/L 265-400 square feet/gallon).

b. Portland Cement Concrete Primer: Primer shall be applied to all concrete pavements (including concrete bridge decks) at a wet film thickness of between 1.0 to 1.3 mm 0.04 to 0.05 inch (30-40 square meters/L 320-400 square feet/gallon).

3.2.2.3 Markings

After the primer has "set-up", the thermoplastic shall be applied at temperatures no lower than 190 degrees C 375 degrees F nor higher than 220 degrees C 425 degrees F at the point of deposition. Immediately after installation of the marking, drop-on glass spheres shall be mechanically applied so that the spheres are held by and imbedded in the surface of the molten material.

a. Extruded Markings: All extruded thermoplastic markings shall be applied at the specified width and at a thickness of not less than 3.0 mm 0.125 inch nor more than 5.0 mm 0.190 inch.

b. Sprayed Markings: All sprayed thermoplastic markings shall be applied at the specified width and the thicknesses designated in the contract plans. If the plans do not specify a thickness, centerline markings shall be applied at a wet thickness of 2.0 mm 0.090 inch, plus or minus 0.10 mm 0.005 inch, and edgeline markings at a wet thickness of 1.5 mm 0.060 inch plus or minus 0.10 mm 0.005 inch.

c. Reflective Glass Spheres: Immediately following application, reflective glass spheres shall be dropped onto the molten thermoplastic marking at the rate of 1 kg/2 square meters 1 pound/20 square feet of compound.

3.2.3 Preformed Tape

The pavement surface temperature shall be a minimum of 15 degrees C 60 degrees F and the ambient temperature shall be a minimum of 15 degrees C 60 degrees F and rising. The preformed markings shall be placed in accordance with the manufacturer's written instructions.

3.3 MARKING REMOVAL

Pavement marking, including plastic tape, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

END OF SECTION

SECTION 02812
LANDSCAPE IRRIGATION SYSTEM PERFORMANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Pipe sleeves under paving for irrigation system.
B. Pipe and fittings, valves, outlets, backflow preventer, and accessories.
C. Connection to utilities and meter installation.
D. Automatic control system.

1.02 RELATED SECTIONS
A. Section 02210 - Grading.
B. Section 02920 – Lawns and Grasses.

1.03 REFERENCES
A. ASTM D 2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).
B. ANSI/ASTM D 2564 - Solvent Cement for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

1.04 DESIGN AND SYSTEM DESCRIPTION
A. Contractor's design for automatic, electric valve, irrigation system 100 percent coverage and minimal over spray onto buildings and paved surfaces to meet the following design standards:
   1. Separate valve zones for turf and bed areas.
   2. Space outlets (sprinkler heads) to provide near 100% overlapped coverage between each outlet.
   3. Specify sizing for all piping, and equipment items.
   4. Specify locations for controller and backflow preveter and coordinate with owner and general contractor.
   5. Piping to be located along back of curbs, pavement edges, and bed edges.
   6. Spray from perimeter of areas where feasible.
   7. Specify equipment brand/s proposed for use.
   8. Provide 100% coverage of all newly planted landscape areas and/or other areas as indicated in the Landscape Plan.
   9. Minimize the number of outlets, trenching, and pipe installation where possible.
   10. Indicate size and locations for irrigation sleeves and coordinate installation with general contractor.
   11. Water meter to be provide by General Contractor.

B. System shall include the following components:
   1. PVC pipe and fittings.
   2. Backflow preventer device, manual ball valve, and insulated fiberglass housing.
   3. Automatic controller and connection to power source.

4. Master valve and zone valves.
5. Valve boxes and covers.
6. Pop-up spray and stream rotor type outlets (sprinkler heads).
7. Rain sensor shutoff device.
8. Low point manual drain valves and drain sumps.
9. 6" PVC pipe sleeves at all pavement crossings. Coordinate with owner and General Contractor. Sleeving may be installed by others.

1.05 SUBMITTALS

A. Shop Drawing Required: Proposed to meet design standards as outlined in 1.04, A, "Design and System Description." Illustrate system over base of site information including site structures, plant and landscaping features. Provide complete schedule of equipment, outlets, valves, etc. to be used. Provide typical details for installation of outlets, valves and backflow preventer.

B. Product Data: Provide manufacter's information and specifications for all system components proposed for use.

1.06 PROJECT RECORD DOCUMENTS

A. Prepare record drawing of irrigation system with accurate locations of sleeving, piping, outlets, valves, drains, and other system components.

1.07 OPERATION AND MAINTENANCE DATA

A. Furnish to Owner instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

B. Furnish to Owner schedule indicating length of time each valve zone is required to be open to provide appropriate amount of water for normal watering schedules.

1.08 REGULATORY REQUIREMENTS

A. Conform to applicable plumbing codes for piping and component requirements.

B. Provide certificate of compliance from local authority indicating approval of piping and backflow preventer installation.

1.09 FIELD MEASUREMENTS

A. Verify that field conditions are as shown on shop drawings and base sheets. Revise for record drawing as required.

1.10 EXTRA MATERIALS

A. Furnish to Owner the following extra components:
1. Two sprinkler heads of each type and size.
2. Two nozzle inserts for each type and size.
3. Two keys each for valve boxes and controller.
4. Two of any required special tools for adjustment or replacement of each type of outlet, nozzle, valve, and other system equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. RAINBIRD by Rain Bird Sales Inc., Turf Division, or approval equal.

2.02 MATERIALS

A. Pipe: PVC in accordance with ASTM D 2241: PVC 1120-1220, Schedule 40 main line upstream from control valves: PVC 1120-1220 class 200 pipe downstream; solvent-weld sockets.
B. Fittings: Type and style of connection to match pipe.
C. Solvent Cement: ANSI/ASTM D 2564 for PVC pipe and fittings.
D. Sleeve Materials: 6-inch Schedule 40 PVC pipe.

2.03 OUTLETS

A. General: High impact plastic, plastic housed stainless steel, brass or bronze construction types.
B. Stream Rotor Type Outlets: Pop-up type with filter screens and internal check valves; adjustable for arc coverage and radius of throw; outlet and nozzle type matched for coverage conditions. Shrub type heads are mounted on fixed riser assemblies.
C. Spray Type outlets: Pressure regulating pop-up type head with internal check valves full circle, part circle, rectangular,fixed arc, or adjustable patterns and adjustable radius of throw. Turf area outlets to be 6” pop-up height. Shrub area placements to be 12” pop-up height to spray over plants. Shrub area placements associated with large shrubs to be on 6” pop-up outlets and designed to water small groups of shrubs of shrubs at ground level.
D. Bubbler: Adjustable outlet and pop-up head or fixed riser assembly.

2.04 VALVES

A. Master valve: Electric solenoid; plastic or fiberglass housed stainless steel, brass or bronze construction; female thread; globe or globe/angle type valve. Flow and operating pressure ranges as follows:
   1. Flow: 1” valves, 0.5-50 gpm; 1-½” valves, 20-150 gpm; 2” valves, 50-200 gpm.
   2. Operating Pressure: 20-200 PSI.
   3. Size for maximum pressure loss of 5 PSI for designed flow rate.
B. Control Valves: Flow control; electric solenoid; plastic or fiberglass housed stainless steel, brass or bronze construction; male or female thread; globe type valve. Flow and operating pressure ranges as follows:
   1. Flow: : 1” valves, 0.5-50 gpm; 1-½” valves, 20-150 gpm; 2” valves, 50-200 gpm.
   2. Operating Pressure: 20-200 PSI.
   3. Size for maximum pressure loss of 5 PSI for designed flow rate.
C. Backflow Preventers: Wilkins/Zurn model 975XL, or equal, sized for maximum flow in system with a maximum pressure loss limited to 10% of available static pressure.
D. Water Meter: Sized for maximum flow in system with a maximum pressure loss limited to 10% of the available static pressure.

E. Valve Boxes and Covers: High impact plastic.
F. Drain Valves: Manual, plastic, brass, or bronze for low points in system.

2.05 CONTROLS

A. Controller: Automatic controller for electric valves with internal transformer, solid state electronics, temporary override feature to bypass cycle for inclement weather, station capacity sized according to system with master valve circuit. Programmable for 14 day watering cycles with 3-60 minute intervals, automatic start, and shutdown.
B. Controller Housing: Plastic or steel, weatherproof, with lockable access door.
C. Accessories: include required fittings, galvanized metal electrical conduit, and accessories for installation.
D. Wire: Color coded and properly sized for length of runs to valves with waterproof connectors.
E. Rain Sensor: Automatic, debris proof, adjustable shutoff device to disable/delay operations during or recently after rainfall.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.
B. Verify location of existing utilities. Repair utilities damaged as a result of this work at no increase in Contract Sum.
C. Verify that required utilities are available in proper location and ready for use.
D. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

A. Provide service tap to water source and installation of water meter.
B. Layout and stake locations of system components.
C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system. Notify Architect/Engineer for approval of field changes to system design.
D. Coordinate with owner, Architect/Engineer, and electrical contractor for location of controller and connection to power source.

3.03 TRENCHING

A. Minimum Trench Depth: 12 inches for irrigation lines.
B. Trench to accommodate grade changes and slope to manual drain valves at low points in system.
C. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

A. Install and bed sleeves under pavement crossings in accordance with specifications of local governing authority for backfill and bedding.

B. Install pipe, backflow preventer, valves, controls, and outlets in accordance with manufacturer's instructions.
C. Provide 12" diameter by 24" deep, gravel filled drain sump at each manual drain value location.
D. Connect to water and electrical service.
E. Set sprinkler heads and box covers at finish grade elevations.
F. Provide for thermal movement and thrust blocking of components in system.
G. Use threaded nipples for risers to each outlet to facilitate replacement.
H. Install control wiring. Provide 10-inch expansion coil at each valve and at 100 feet intervals. Bury wire beside pipe. Mark valves with installed valve boxes and covers containing locking device. Enclose control wiring in electrical conduit from controller to wire burial depth. Paint exposed conduit to match building.
I. Install automatic controller. Provide hardwired connection to power source, enclose wiring to system and power source in rigid metal conduit where exposed. Coordinate location connection to power source, and wiring route with Owner, Architect/Engineer and contractor.Paint exposed conduit to match building exterior.
J. Install rain sensor device wire to controller. Coordinate location and wiring route with Owner, Architect/Engineer, and contractor. Enclose all wiring in rigid metal conduit where exposed. Paint exposed conduit to match building exterior.
K. After piping is installed but before sprinkler heads are installed and trenches backfilled, open valves and flush system with full head of water.
L. Repair or replace any other work or improvements damaged as a result of work related to system installation at no increase to the Contract Sum.

3.05 FIELD QUALITY CONTROL

A. Prior to backfilling, cap or plug outlet pipes and test system for leakage. Maintain 100 psi pressure for one hour. System acceptable if no leakage or loss of pressure occurs during test period.

3.06 BACKFILLING

A. Backfill sleeve trenches under pavement crossings and compact to sub grade elevation in accordance with site specifications for sub grade preparation. Protect piping from displacement.
B. Backfill and compact all pipe trenches to prevent settlement.

3.07 ADJUSTING

A. Adjust control system to achieve time cycles required for adequate watering.
B. Change or adjust heads and/or nozzles to achieve proper coverage and performance with a minimum of over spray on to paved surfaces, buildings, and other sprinkler zone areas.

3.08 DEMONSTRATION

A. Provide system demonstration to Owner and Architect/Engineer for final acceptance.

B. Instruct Owner personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance material as basis for demonstration.
C. Submit record drawing of system indicating any changes to final layout and show locations, sizes, types, etc. of all system components.
D. Submit required extra materials (parts) as specified.

3.09 INSTALLER'S FIELD SERVICES

A. Provide one complete spring startup and a fall shutdown.

3.10 WARRANTY

A. Provide one year materials and workmanship warranty on all system components
and installation beginning on date of acceptance of the work.
B. Replace failed components immediately upon notification by Owner or Architect/Engineer.

END OF SECTION

SECTION 02920
LAWNS AND GRASSES

PART 1 GENERAL

1.1 SUMMARY

Fine grade all areas not covered by buildings or structure, paving or planting areas or otherwise designated. Furnish and install seeding, sprigging, soil supplements, and accessories as specified. Accomplish maintenance and turf establishment as specified. In the event construction prevents planting of the Bermuda grass turf areas during the specified seeding season, apply an approved temporary erosion control method to stabilize soil until Bermuda grass is established in specified seeding season.

Section Includes:

Preparation of topsoil.
Placing topsoil, soil amendments, mulch, and fertilizer.
Sprig, Turfgrass SOD, Hydroseeding and Hydromulching.
Maintenance.

Related Sections:

Section 02200 – Earth Work
Section 02812 - Landscape Irrigation System Performance

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)
AMS-01 Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM C 602 Agricultural Liming Materials
ASTM D2944 Standard Test Method of Sampling Processed Peat Materials
ASTM D2973 Standard Test Method for Total Nitrogen in Peat Materials
ASTM D2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D2976 Standard Test Method for pH of Peat Materials
ASTM D2977 Standard Test Method for Particle Size Range of Peat Materials for Horticultural Purposes
ASTM D2978 Standard Test Method for Volume of Processed Peat Materials
ASTM D2980 Standard Test Method for Volume Weights, Water-Holding Capacity, and Air Capacity of Water-Saturated Peat Materials
ASTM D4427 Standard Classification of Peat Samples by Laboratory Testing

ASTM D 4972 Standard Test Method for pH of Soils
ASTM D 5268 Standard Specification for Topsoil Used for Landscaping Purposes
ASTM D5883 Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

FEDERAL SPECIFICATIONS (FS) GENERAL SERVICES ADMINISTRATION, Federal Supply Service Bureau, 470 L'Enfant Plaza, S.W. Washington, DC 20407
FS O-F-241 Fertilizers, Mixed, Commercial.
FS JJJ-S-181 Seeds, Agricultural

STAFF OF THE L.H. BAILEY HORTORIUM, CORNELL UNIVERSITY
HORTUS THIRD A Concise Dictionary of Plants Cultivated in the United States and Canada - Reference of botanical plant names.

1.3 DEFINITIONS

Noxious Weeds: Bentgrass (*Agrostis spp.*), Bindweed (*Convolvulus spp.),* Bromegrass (*Bromus spp.*), Dodder (*Cuscuta sp.*), Ground Ivy (*Glechoma hederacea*), Johnson Grass (*Sorghum halepense*), Leafy spurge (*Euphorbia esula*), Nimblewill (*Muhlenbergia shreberi*), Nutgrass or nutsedge (*Cyperus spp.),* Perennial Sorrel (*Oxalis spp*.), Perrenial Sowthistle (*Sonchus arvensis*), Poison Ivy (*Toxicodendren Radicans*), Russian Knapweed (*Centaurea picris*), Quackgrass (*Agropyron repens*), Thistle (*Cirsium spp.*), Whitetop (*Lepidium draba, Lepidium repens, Hymenos-physa pubescens*), and Wild Garlic (*Allium vineale*).

Weeds: Annual Bluegrass (*Poa annua)*, Tall fescue (*Festuca eliator*), Barnyardgrass (*Echinochloa crus-galli*), Blackberry (*Rubus spp*.), Burclover (*Medicago hispida*), Crabgrass (*Digitaria spp.*), Chickweed (*Stellaria media*), Chess (*Bromus spp.*), Dallisgrass (*Paspalum dilatatum*), Dandelion (*Taraxacum officinale*), Dock (*Rumex spp.),* English Daisy, (*Bellis perrene*), Foxtail (*Alopecus spp*.), Henbit (*Lamium amplexicaule*), Horsetail (*Equisetum arvense*), Jimsonweed (*Datura stramonium*), Knotweed (*Polygonum aviculare*), Lambsquarter (*Chenopodium album*), Mallow or Cheesweed (*Malva spp*.), Morning Glory (*Cusutata spp.*), Mustard (*Sisymbrium spp.)*, Plantain (*Plantago spp*.), Poison Oak (*Toxicodendren toxicarium*), Purslane (*Portulaca oleracacea*), Ragwort (*Senecio spp.*), Rush grass (*Juncus spp*.), Spotted spurge (*Euphorbia maculata*), Veronica or Speedwell (*Veronica filiformis*), and Wild Onion (*Allium canadense*).

1.4 SUBMITTALS

A. Product Data: Manufacturer's literature, including physical characteristics, application and installation instructions.

1. Equipment: Hydroseeder and Hydromulcher.

2. Fertilizer.

B. Shop Drawings: Tagged plant locations.

C. Samples

1. Edging: 1 ft (300 mm) sample of edging including stake and staking bracket

2. Topsoil: Samples taken from several locations at the source.

3. Submit minimum 10oz (280 g) sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

4. Testing is not required if recent tests are available for imported topsoil.

a. Submit these test results to the Landscape Architect for approval.

5. Soil Amendments: 5 lbs (2.26 kg) sample of each type.

6. Temporary Seeding: 5 lbs (2.26 kg) sample of annual seed species and application rate

7. One pound sample of mulch;

8. 5 lbs (2.26 kg) sample of fertilizer.

D. Quality Control/Assurance Submittals:

1. Test Reports

a. Results of soil analysis for existing and imported topsoils with recommended soil amendments. Provide analysis of topsoil fill under provisions of Section 01400.

1) Analyze to ascertain textural class, particle size, percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

b. Seed. Classification, botanical name, common name, percent pure seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

c. Package standard products with manufacturer's certified analysis.

d. Fertilizer: For chemical analysis, composition percent.

e. For other material provide analysis by a recognized laboratory, made in accordance with methods established by the association of official Agricultural Chemists.

2. Certificates: Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements.

a. Submit shipping tags to Landscape Architect upon delivery of materials.

b. Department of Agriculture certificates from the state or point of origin (or purchase) declaring that the material is alive, in good health and free from insects and disease.

c. Arkansas Code §2-16-210 Plant Board Inspection and Certificate for Plant Materials and Products. Inspection certificates complying with all local, and federal regulations.

3. Sprigs: Cultivar name, genetic purity and field location.

4. Topsoil: article size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

5. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

6. Fertilizer: Chemical analysis and composition percent.

7. Agricultural Limestone: For calcium carbonate equivalent and sieve analysis.

8. Peat: For compliance with ASTM D2980 AND D4427.

E. Qualification Statements

1. Turfgrass Grower supplier:
Submit evidence of experience.

2. Landscape Contractor:
Submit evidence of experience.

F. Delivery Schedule

Delivery schedule, at least 14 days prior to the intended date of the first delivery.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Sprig Producer: Company specializing in turfgrass sprig propagation with five years documented experience.

2. Seed Producer: Company specializing in turfgrass seed propagation with five years documented experience.

3. Installer: Company specializing in turfgrass and plant installation with five years documented experience.

B. Provide seed mixture in containers showing percentage of seed mix, origin of seed, year of production, percent germination, net weight, testing date, date of packaging, and location of packaging.

C. Regulatory Requirements

Comply with regulatory agencies for fertilizer and herbicide composition.

D. State Regulatory Requirements - Comply with Arkansas Code Annotated (ACA)

1. §2-16-210 Plant Board Inspection and Certification

2. §2-16-401 Pesticide and Pesticide Disposal

3. §2-21-101 Nursery Fraud and License

4. §17-25-101 Contractor Licensing

5. §20-20-201 Pesticide Application License

E. Inspections, Permits, And Fees

1. Contractor

a. Obtain and pay for all required permits, and inspections in connection with this work under the Contract.

b. Deliver to the Owner a copy of each certificate of approval from each inspection agency.

c. Pay for required testing.

d. Pay any and all fees in connection to all utilities and pay all utilities bills during construction.

e. Bear all costs of correcting deficiencies of any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, and utility company regulations.

2. Testing Facilities

a. An approved commercial testing laboratory; or

b. Facilities furnished by the Contractor.

c. DO NOT perform any work requiring testing until the facilities have been inspected and approved by the Landscape Architect.

d. The first inspection of the testing facility is at the expense of the Owner.

e. Required subsequent inspection because of first inspection failure is the expense Contractor at no additional cost to the Owner.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Deliver, store, protect, and handle products to site under provisions of Section 01500.

2. Provide delivery schedule at least 10 days prior to delivery.

3. Protect sprigs during shipping, handling and delivery to prevent desiccation, internal heat buildup, or contamination.

a. DO NOT damage sprigs during packing, handling and unloading.

b. DO NOT drop or dump materials from vehicles.

4. Deliver grass seed mixture in the original, unopened containers. Seed in damaged packages is unacceptable.

5. Deliver fertilizer in the original, unopened waterproof bags showing weight, chemical analysis, and name of manufacturer. Fertilizer in damaged packages is unacceptable.

6. Deliver soil amendments in the original, unopened containers bearing the manufacturer's chemical analysis. Soil amendments in damaged packages is unacceptable.

7. Soil amendments may be furnished in bulk.

8. Provide a chemical analysis for bulk deliveries.

B. Acceptance at Site

1. Inspect sprigs for:

a. conformity to cultivar and genetic purity;

b. attached roots with 2 to 3 nodes;

c. 4 to 6 in (100 to 150 mm) in length, with no adhering soil, weed stems, or roots.

d. Reject sprigs exposed to excessive heat or drying.

2. Inspect seed for:

a. conformity to cultivar and quality.

b. Conform to FS JJJ-S-181.

c. Weed seed less than 1 percent by weight of the total mixture.

d. Maximum 1 percent by weight other crop and/or inert seeds.

e. Restricted noxious weeds not to exceed 90 per pound.

f. Free of prohibited noxious weeds.

3. Reject wet, moldy, or damaged seed .

4. Reject seed that is wet, moldy, or bears a test date 5 months or older,

5. Reject sprigs harvested over 24 hours prior to planting.

6. Reject seed held in the slurry for more than 24 hours prior to hydroseeding.

7. Inspect other materials compliance.

a. Reject

1) open soil amendment containers or wet soil amendments;

2) topsoil containing slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 in (40 mm) diameter

3) topsoil containing viable plants and plant parts.

4) topsoil containing toxic substances, or other materials harmful to plant growth.

8. Remove unacceptable materials from the job site.

C. Storage and Protection

1. Store materials in areas designated by the Landscape Architect.

2. Sprigs (N/A):

a. Store in designated areas and cover with moist burlap, straw, or other covering.

b. Use covering that allows air circulation to prevent internal heat build-up.

c. Protect from exposure to wind, and direct sunlight until installed.

3. Store seed, lime, and fertilizer in cool, dry [designated] locations away from contaminants.

4. Store chemical treatment material according to manufacturer's instructions separate from plant material or other materials.

1.7 PROJECT/SITE CONDITIONS

Existing Conditions: For existing topsoil condition see the soil report. Contractor shall contact the local agricultural extension office and submit soil sample to determine if any amendment to the existing top soil is required. Submit the Test results to the Project Engineer.

1.8 SCHEDULING

A. Coordinate the work of this Section with installation of underground sprinkler system piping and watering heads, installation of exterior plants and installation of site furnishing to prevent damage to plants and planting areas.

B. Coordinate with the installation of other site work by other contractors.

C. Planting Coordination: Plant trees, shrubs, groundcovers and vines after final grades are established and before planting of turf unless otherwise approved by the Landscape Architect. If planting of trees and shrubs occurs after turf installation, protect the lawn areas, and promptly repair damage which occurs.

1.9 WARRANTY

A. Provide one year replacement warranty including one continuous growing season under provisions of Section 01700 including coverage of lawns or grass areas for death or unhealthy conditions. All turfgrass shall be uniform in color and care coverage, leaf texture and shoot density, reasonably free of weeds, diseases and other visible imperfections at acceptance.

B. Replacements: Lawn or grass area of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.10 MAINTENANCE

Maintain installed lawn immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.

PART 2 PRODUCTS

2.1 GROWERS AND SEED PRODUCERS

A. Advanta Seeds Pacific. Inc., 33725 Columbus Street, Albany, Oregon 97321-0452, (800) 266-7333

B. Barenbrug USA, 33477 Highway 99E, Tangent, Oregon 97389 (541) 926-5801

C. Ernst Conservation Seeds, 9006 Mercer Pike, Meadville, Pennsylvania 16335, (800) 873-3321

D. Georgia Coastal Plains Experimental Station, Tiffin, Ga.

E. Lofts Incorporated, Bound Brook, New jersey 08805 (800) 526-3890

F. Lofts Affiliate, Sunbelt Seeds, Incorporated, 5172 Indian Trail, Industrial Parkway, Suite A, Norcross, Georgia 30093, (404) 448-9932

G. Kansas Agricultural Experiment Station, Manhatten, Ks.

H. Pennington Seed Company, P.O. Box 290, Madison, Georgia 30650, (800) 285-7333

I. Sunmark Seeds International, 503 NW Irving Street #200a, Portland, Oregon 97209 (503) 241-7333

J. The Scotts Company, 41 South High Street. Suite 3500, Columbus, Ohio 43215, (614) 719-5500, http://www.scottscompany.com.

K. Quail Valley Farm, Inc.. Little Rock, Arkansas.

L. Winrock Grass Farm, Inc.. Little Rock, Arkansas.

M. Substitutions: Under provisions of Section 01600.

2.2 SPRIGS (N/A)

A. 100 percent healthy living stems, stolons or rhizomes of *Cynodon dactylon* 'Tifway T-419' (Tifway Hybrid Bermuda grass) with attached roots from 4 to 6 inches (100 to 150 mm) long and 2 to 3 nodes.

B. Sprig species comply with HORTUS THIRD.

C. Grown under climatic conditions similar to those in the locality of the project.

D. Without adhering soil, weed stems, or roots.

E. Obtained from heavy and dense sod, and free from material detrimental to a healthy stand of grass plants.

F. Protected from excessive heat or drying.

2.3 SEED

A. Provide state-certified seed of the latest season's crop in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material.

B. Labels shall conform to AMS-01 and applicable state seed laws.

C. Hydroseeding Mix: Bermuda Triangle Mix or approved equal.

1. *Cynodon dactylon* (Bermuda Grass 'Mohawk': 33 percent;

2. *Cynodon dactylon* (Bermuda Grass 'Sultan': 33 percent;

3. *Cynodon dactylon* (Bermuda Grass 'Sydney': 33 percent.

D. Temporary Seed Species:

1. *Lolium multiflorum* (Annual Rye Grass): 100 percent.

2.4 SOD/TURFGRASS

1*. Turfgrass Sod Composition*: Turfgrass sod shall consist of a dense, well rooted growth of permanent and desirable grasses, indigenous to the locality it is being placed, that is practically free from weeds or undesirable grasses. When cutting the sod, the grass should be approximately 2inches long.

2. *Turfgrass Sod Quality*: Turfgrass sod shall be of good quality, free of weeds, disease and insects and of good color and density.

3. *Thickness of Cut*: Turf shall be machine-cut at a minimum uniform soil thickness necessary for plant viability during the Harvest-Transport-Installation cycle (at least ¾" thick or more, depending on the nature of the sod, so that practically all of the dense root system is retained, but exposed, in the sod strip and so that handling the sod causes no undue tearing or breaking).

4. *Pad Size*: Individual pieces of turfgrass sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5 percent.

5. *Strength of Turfgrass Sod Sections*: Standard size sections of turfgrass sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

6. *Replacement*: The policy for replacement of turfgrass sod is dependent upon each individual farm. Most replacements extend only to the cost of the turfgrass sod involved, not labor or transportation expenses. Notification of defective turfgrass sod must be made within 24 hours of delivery. Failure to notify the turf farm within the specified time period can result in the farm's refusal to replace the turfgrass sod.

2.5 SUBSTITUTIONS

Substitutions are not be allowed without written request and approval of Landscape Architect.

2.6 SOIL MATERIALS

A. Topsoil: Excavated from site and free of weeds.

B. Imported Topsoil: Imported, ASTM D 4972 and D 5268, fertile, friable, clean, rich, dark, surface, agricultural soil (loamy sand, sandy loam, clay loam or sandy clay loam), approved by the Landscape Architect, capable of sustaining vigorous

plant growth; secured from a well drained arable site with minimum topsoil depth of 4 in (10 cm); containing a minimum 4% and a maximum of 25% of decayed organic matter (humus) ; reasonably free of subsoil, clay, stones, earth clods or impurities, plants, weeds, sticks, roots, or toxic substances or any other material harmful to plant growth. Minimum pH 5.4 and maximum 7.0. Maximum soluble salts 600 ppm (or 4 mmhos). Mix and test random samples of the topsoil as a composite in accordance with standard practices. Process the testing through the County Extension Office or approved independent laboratory. Provide test results to the Landscape Architect. Determine amendments required from the test results. Contractor will pay for sampling and testing. If needed, amend topsoil to adjust Ph.

1. River sand is NOT acceptable.

2. DO NOT obtain from bogs, marshes or steep clayey slopes.

3. DO NOT strip, collect or deposit topsoil while soil is wet.

4. DO NOT deliver topsoil in a frozen or muddy condition.

2.7 SOIL AMENDMENTS

pH adjusters, fertilizer, organic material, and soil conditioners meeting the following requirements.

A. DO NOT use vermiculite.

B. pH Adjuster: an agricultural liming material in accordance with ASTM C 602 (i.e. burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

1. Ground Limestone: ground agricultural limestone.

   a. Minimum calcium carbonate equivalent of 90 percent.
   b. Minimum 90 percent passing a #10 (2 mm) sieve.
   c. Minimum 50 percent passing a #60 (0.250 mm) sieve.

2. Hydrated Lime:

   a. Minimum calcium carbonate equivalent of 110 percent.
   b. Minimum 100 percent passing a #8 sieve (2.36 mm).
   c. Minimum 97 percent passing a #60 sieve (0.250 mm).

3. Burnt Lime

   a. Minimum calcium carbonate equivalent of 140 percent.

b. Minimum 95 percent passing a #8 sieve (2.36 mm).
c. Minimum 35 percent passing a #60 sieve (0.250 mm).

4. Soil sulphur (Flowers of sulphur):

a. Minimum 90 percent passing a #10 (2 mm) sieve.
b. Minimum 50 percent passing a #60 (0.250 mm) sieve.

5. Aluminum sulfate:

a. Minimum 90 percent passing a #10 (2 mm) sieve.
b. Minimum 50 percent passing a #60 (0.250 mm) sieve.

6. Ferrous sulphate:

a. Minimum 90 percent passing a #10 (2 mm) sieve.
b. Minimum 50 percent passing a #60 (0.250 mm) sieve.

C. Fertilizer: FS O-F-241, Type I Grade A controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylene diurea (IBDU)] recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis.

D. Greensand: a potash-based exchange mineral, commercially packaged and free flowing.

1. Minimum 7 percent total potash.

2. Minimum 1 percent phosphorous.

3. Minimum 22 percent trace minerals.

E. Rock Phosphate

1. Contain a minimum of 18-30 percent phosphorous.

2. Minimum of 3 percent initial availability.

3. Commercially packaged and free flowing.

F. Organic Material: peat, bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

1. Peat: A natural, granulated, or shredded commercial Sphagnum Peat Moss or Peat Humus derived from a bog, swampland or marsh, containing not more than fifteen (15) percent decomposed organic matter by weight, low in content of woody material, free of materials harmful to plant life; with a pH of from 4 to 6, a moisture content of not over 30% and a moisture absorbing capacity from 1100% to 2000%.

2. Bonemeal: finely ground, steamed bone product, containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

3. Rotted Manure: unleached horse, chicken, or cattle manure, heat treated to kill weed seeds, containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials, free of stones, sticks, soil, and toxic substances harmful to plants.

4. Compost: Commercially produced stable humus mixture of well aerobically decomposed, stable, weed free organic matter source derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste free of objectionable odors and toxic substances harmful to plants

    a. cleaned of all plastic materials;
    b. composted for a minimum of five weeks;
    c. one to three percent nitrogen, phosphorus, and potassium;
    d. pH 5.5 to 8.0;
    e. 35 - 55% moisture content by weight;
    f. maximum one percent man-made material;
    g. no glass or metal shards;
    h. Screened

        1. 100% passing a 3/8 in (10 mm) screen
        2. Minimum 95% by weight less than 1/4 inch (6 mm) diameter.
        3. maximum 5% greater than 1/4 inch (6 mm) diameter.
        4. maximum 65% greater than 3/64 inch (1 mm) diameter.
        5. minimum 35% less than 3/64 inch (1 mm) diameter.

    i. fecal coliform populations less than 1,000 MPN/ gm total solids dryweight;
    j. salmonella species populations 3 MPN/gm total solids dryweight.

5. Worm Castings: commercially packaged, screened from worms and food source.

G. Soil Conditioner: sand, calcined clay, or gypsum for use singly or in combination to meet the requirements for topsoil.

1. Sand

a. Sand shall be clean and free of toxic materials.

b. Gradation: A minimum 95 percent by weight shall pass a 2 mm No. 10 sieve and a minimum 10 percent by weight shall pass a 1.18 mm No. 16 sieve.

c. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2. Calcined Clay

a Calcined clay shall be granular particles produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. 1200 degrees F.

b. Gradation: A minimum 90 percent passing 2.36 mm No. 8 sieve; a minimum 99 percent shall be retained on a 0.250 mm No. 60 sieve; and a maximum 2 percent shall pass a 0.150 mm No. 100 sieve.

c. Bulk density: A maximum 640 kilogram per cubic meter 40 pounds per cubic foot.

3. Gypsum: commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

4. Expanded Shale, Clay, or Slate (ESCS): ASTM D5883.

2.7 MULCH

Free from weeds, mold, and other deleterious materials and native to the region.

A. Wood Cellulose Fiber Hydro-Mulch:

1. Conwed Hydro-Mulch 2000 or Silva Fiber Plus or approved equal;

2. Does not contain any growth or germination-inhibiting factors.

3. Dyed an appropriate color to facilitate visual metering during application with integral tactifier.

4. Composition on air-dry weight basis:

a. 9 to 15 percent moisture.

b. pH range from 4.5 to 6.0

2.8 WATER

Clean, fresh, and free of substances or material which could inhibit vigorous growth of grass.

2.9 HERBICIDE

Systemic: Glyphosate (Roundup® or Kleenup®)

2.10 ACCESSORIES

A. Stakes: Softwood lumber, chisel pointed.

B. String: Organic fiber.

C. Edging

D. MANUFACTURERS

1. Collier Metal Specialties Incorporated, 3333 Miller Park South, Garland Texas 75042, (800) 829-8225,http://www.colmet.com.

2. Joseph T. Ryerson and Son Incorporated, P.O. Box 8000, Chicago, Illinois 60680, (773) 762-2121].

3. ProSteel, 5121 Kaltenbrun Road, Fort Worth, Texas 76119, (800) 542-4518, http://www.prosteel.com.

a. Substitutions: Under provisions of Section 01600.

4. 3/16 inch x 5 inch (5 mm x 13 cm) galvanized steel edging band.

5. Pre-formed stake straps, stakes and end stakes.

6. Rust resistant painted or powder coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site verification of Conditions:

1. Prior to the commencement of hydroseeding and sprigging operation, verify finished grades, and topsoil placement, finish grading, and compaction requirements are complete.

2. Verify subsoil is not frozen, muddy, excessively wet or in conditions detrimental to grading or turfgrass installation.

3. Verify sufficient time has elapsed to ensure dissipation of all toxic materials (chemicals, herbicides, pesticides, etc.) from the subsoil and topsoil.

a. Contractor is responsible for any loss or damage to turfgrass arising from improper use of chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues.

4. Verify that prepared soil base is ready to receive the work of this Section.

5. Beginning of installation means acceptance of existing site conditions.

3.2 PREPARATION

A. Protection: Protect areas with prepared surfaces from compaction and damage by vehicular or pedestrian traffic and surface erosion.

B. Preparation of Subsoil and Sprig, Seed Planting Bed:

1. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

2. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

3. Eliminate all existing vegetation from seedbed by herbicide.

a. Spray seedbed with glyphosate herbicide following manufacturer’s instructions.

b. Maintain seedbed bare and moist for three weeks.

c. Spray seedbed with second herbicide application.

d. Maintain seedbed bare and moist for one week following second herbicide application.

e. DO NOT apply seed or sprigs for at least one week after last herbicide application to allow herbicide to completely breakdown.

f. Scarify subsoil to a depth of 3 inch (75 mm) where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

C. Surface Preparation:

1. Clear the turfgrass planting bed to a depth of 4 inch (10 cm) of all roots, brush, wire, grade stakes, surface trash or other objects that would hinder installation or maintenance of turfgrass and other plantings.

2. Remove debris and stones over 5/8 inch (16 mm).

3. Set the prepared surface a maximum of 1 inch (25 mm) below the adjoining grade of any surfaced area.

4. Blend new surfaces to existing areas.

5. Roll prepared surface and complete by a light raking to remove debris.

3.3 SITE PREPARATION

A. Application of Soil Amendments

1. pH Adjustment:

a. Apply pH adjustment, fertilizer and soil conditioning at the rate recommended by the soil test.

b. Incorporate pH adjustment, fertilizer and soil conditioning into the soil to 6 inch (15 cm) depth as part of the tillage operation.

B. Tillage

1. Till level soil and slopes less than 33 percent(gentler than 3:1) to a minimum depth of 6 inches (150 mm). Till soil on slopes less than 33 percent (gentler than 3:1) to a minimum depth of 6 inches (150 mm). Till soil on slopes between 33 percent to 100 percent (between 3:1 and 1:1) to a minimum depth of 2 inches (50 mm) by scarifying with heavy rakes, or other method. No tilling is required on slopes 100% (1:1) and steeper, scarify with rake.

2. Use mechanical and powered tillers where soil conditions and length of slope permit.

3. Maintain drainage patterns indicated on drawings.

4. Completely pulverize areas compacted by construction by tilling.

5. Repair surface erosion or grade deficiencies with topsoil.

6. The pH adjustment, fertilizer and soil conditioner may be applied during tilling.

C. Placing Topsoil

1. Scarify areas to receive topsoil to a depth of 3 inches (76 mm) to bond topsoil with subsoil.

2. Spread topsoil to a minimum depth of 4 inches (10 cm) over area to be seeded. Rake until smooth.

3. Place topsoil during dry weather and on dry unfrozen subgrade.

4. Remove vegetable matter, debris and stones larger than 5/8 inch (16 mm) in any dimension, and foreign non-organic material from topsoil while spreading.

5. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.

6. Install edging at periphery of lawn areas in as indicated on drawings to consistent depth.

3.4 INSTALLATION

A. Prior to installing sod, seed and sprigs, repair any previously prepared surface compacted or damaged.

B. SODDING

1. *Moistening the Soil*: After all grading has been completed, the soil shall be irrigated within 12 to 24 hours prior to laying the turfgrass sod. Turfgrass sod should not be laid on soil that is dry and powdery.

2. *Starter Strip*: The first row of turfgrass sod shall be laid in a straight line, with subsequent rows placed parallel to, and tightly against, each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to insure that the turf is not stretched or

overlapped, and that all joints are butted tight in order to prevent voids, which would cause air-drying of the roots.

3. *Sloping Surfaces*: On sloping area where erosion may be a problem, turfgrass sod shall be laid with staggered joints and secured by pegging.

4. *Watering*: The contractor shall be responsible for watering turfgrass sod immediately during and after installation to prevent drying. It shall then be thoroughly irrigated to a depth sufficient that the underside of the new turfgrass sod pad and soil immediately below the turfgrass sod are thoroughly wet (usually 1 inch of water is needed). The general contractor shall be responsible for having adequate water available at the site prior to and during installation of the turfgrass sod.

5. Maintenance of installed turfgrass sod: Unless stated otherwise, the contractor shall furnish all labor material and equipment required to complete the work described herein in strict accordance with the drawings and/or terms of the contract. The general contractor shall supply adequate water to the site.

TIME LIMITATION: Duration of maintenance responsibilities by landscape contractor shall be for 30 days or until otherwise specified in writing by the owner, architect, or general contractor.

C. WATERING:

1. *First Week*: The landscape contractor shall provide all labor and arrange for all watering necessary for establishment of the turfgrass sod. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least 4 inches. Watering should also be done during the heat of the day to help prevent wilting.

2. *Second and Subsequent Weeks*:
The landscape contractor shall water the turfgrass sod as required to maintain adequate moisture in the upper 4 inches of soil. Avoid application of too much water. Turfgrass sod should not be continually saturated. Depending on the sprinkler, as little as 20 to 30 minutes of water application may be sufficient; other sprinklers may requires longer water application times.

D. MOWING: For bluegrass or bluegrass/fescue turfgrass sod, turfgrass height shall be maintained between 11/2 and 21/2 inches unless otherwise specified. Not more than 1/3 of the grass leaf shall be removed by the initial cutting or subsequent cuttings. For bentgrass sod, initial turfgrass height shall be maintained as specified by the grower or installer. Not more than 1/3 of the grass leaf shall be removed by the initial cutting or subsequent cuttings. Height of bentgrass turf may be gradually reduced to the desired cutting height by weekly or more frequent lowering of the mower setting as specified by the grower or installer.

E. DISCLAIMER: The landscape contractor shall not be held liable for damages to turfgrass sod caused by de-icing compounds, fertilizers, pesticides, herbicides and other materials not applied by him or her or under his or her supervision nor those caused by acts of God or vandalism.

F. GUARANTEE: The landscape contractor shall guarantee work covered by this specification.

G. Sprigging (N/A)

1. Sprig areas as indicated.

2. Sprigging Seasons:

   a. Install Bermuda grass sprigs from April 15 to June 15 for spring establishment; from June 15 to August 1 for summer establishment.

   b. Sprigging Conditions

   c. Perform sprigging only during periods when beneficial results can be obtained.

   d. Stop sprigging when drought, excessive moisture, or other unsatisfactory conditions prevail.

   e. Submit proposed alternate for approval, when special conditions warrant a variance to the sprigging season or operations.

3. Use broadcast, hydrosprigging or row sprigging method and ensure even coverage.

4. Broadcast Sprigging:

   a. Broadcast sprigs uniformly with mechanical equipment or other approved method.

b. Plant sprigs to provide a minimum 50 viable sprigs/square yard (60 viable sprigs/sq m).

c. Space sprigs a maximum 6 inches (300 mm) apart.

d. Force sprigs into the soil a minimum 1 inch (25 mm) depth by disk-rolling, pressing with steel matting, or other approved method.

5. Hydrosprigging:

a. Mix sprigs with water and hydromulch and uniformly apply under pressure over the entire area to provide a minimum 50 viable sprigs/square yard (60 viable sprigs/sq m).

b. Cover sprigs by distributing a topdressing of topsoil uniformly and evenly to a minimum 1 inch (25 mm) depth.

6. Mechanical Sprigging:

a. Plant sprigs in rows spaced a maximum 12 inches (300 mm) apart and to a minimum 1 inch (25 mm) depth, with mechanical sprig planter or other methods to provide a minimum 50 viable sprigs/square yard (60 viable sprigs/sq m).

b. Place sprigs in the rows a maximum 6 inches (150 mm) apart.

H. Mulching

1. Wood Cellulose Fiber:

a. Apply wood cellulose fiber mulch as part of the hydrosprigging and hydroseeding operation.

b. Apply and mix mulch in accordance with the manufacturer's recommendations.

I. Hydroseeding

1. Hydroseed areas as indicated.

2. Hydroseeding Seasons:

a. Hydroseed Bermuda grass from April 15 to June 15 for spring establishment; from June 15 to August 15 for summer establishment.

3. Hydroseeding Conditions:

   a. Perform Hydroseeding only during periods when beneficial results can be obtained.

   b. Stop Hydroseeding when drought, excessive moisture, or other unsatisfactory conditions prevail.

   c. Submit proposed alternate for approval, when special conditions warrant a variance to the sprigging season or operations.

4. Apply mulch/seed slurry to slopes of 33% (3:1) or less at a rate of 1500 lbs/acre (1700 kg/ha) evenly in two intersecting directions, with a hydraulic seeder.

5. Apply mulch/seed slurry to slopes exceeding 33% (3:1) at a rate of 2000 lbs/acre (2,300 kg/ha) evenly in two intersecting directions, with a hydraulic seeder.

6. Maintain clear of shrubs and trees.

7. Apply water with a fine spray immediately after each area has been hydroseeded. Saturate to 4 inches (10 cm) of soil.

J. Hydromulching

1. Apply mulch slurry to slopes of 33% (3:1) or less at a rate of 1500 lbs/acre (1700 kg/ha) evenly in two intersecting directions, with a hydraulic seeder.

2. Apply mulch slurry to slopes exceeding 33% (3:1) at a rate of 2000 lbs /acre (2,300 kg/ha) evenly in two intersecting directions, with a hydraulic seeder.

3. Mix hydromulch for a minimum of 8-15 minutes before application to activate tackifier.

4. Immediately following broadcast or mechanical row sprigging, apply mulch to a thickness of 1/8 inch (3 mm).

5. Maintain clear of shrubs and trees.

6. Apply water with a fine spray immediately after each area has been hydroseeded. Saturate to 4 inches (10 cm) of soil.

K. Rolling

1. Firm the sprigged area with a roller not exceeding 90 lbs/ft (130 kg/m) of roller width.

2. DO NOT roll slopes over 4:1 (25%).

L. Finishing

A minimum 25 percent of the installed sprigs shall extend above the ground surface upon completion of the sprigging operation.

M. Watering Sprigs

1. Begin watering sprigged and seeded areas immediately after completing sprigging operations for the day.

2. Apply water at a rate to moisten soil to minimum 1 inch (25 mm) depth.

3. Prevent run-off, puddling, wilting and over watering of adjacent areas or plant material.

4. DO NOT drive watering trucks over turf areas.

3.5 TEMPORARY SEEDING

A. Apply seed at 10 lbs/1,000 square yards (2.3 kg/sq m.)

B. Seed designated areas when directed or during delays affecting the hydroseeding or sprigging operation to provide quick cover to prevent erosion.

C. Soil Amendments

1. If temporary seeding areas have not been prepared with soil amendments, apply 1/2 of the required soil amendments and till the area.

2. Water the area as required.

3. Apply the remaining soil amendments when the surface is prepared for installing sprigs.

3.6 APPLICATION OF PESTICIDE

A. Submit pesticide treatment plan, when application of a pesticide becomes necessary to remove a pest or disease, and coordinate with the installation pest management program.

B. Technical Representative

1. The certified installation pest management coordinator is the technical representative.

2. Technical Representative shall be present at all meetings concerning treatment for pest or disease control and during treatment application.

C. Application

1. Use a state certified applicator to apply pesticides in accordance with EPA label restrictions and recommendations.

2. Utilize protective clothing and equipment as specified on the pesticide label.

3. Water for formulating shall only come from designated locations.

4. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards.

5. Prevent overflow during filling operation.

6. Inspect application equipment prior to each day of use for leaks, clogging, wear, or damage. Perform any repairs immediately.

3.7 REPAIR/RESTORATION

Repair existing turf areas, pavements, and facilities damaged by hydroseeding or sprigging operations to original condition at Contractor's expense.

3.8 FIELD QUALITY CONTROL

A. Site Tests, Inspection:

1. Equipment Calibration:

a. Immediately prior to the commencement of sprigging operations, conduct calibration tests on the equipment to be used.

b. Confirm that the equipment is operating within the manufacturer's specifications and can meet the specified criteria.

c. Calibrate equipment a minimum of once every day during the operation.

d. Provide the calibration test results within 1 week of testing.

2. Soil Test

a. Test delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil in accordance with ASTM D 5268 and ASTM D 4972 to determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis.

b. Samples:

1) Sample soil to provide a representative sample of the soil type being tested.

2) Take existing soil samples at random locations on site over the entire sprig bed.

3) Take stockpiled topsoil samples at different levels in the stockpile.

c. Use tests to determine the quantities and type of soil amendments required to meet local growing conditions for the sprig cultivar specified.

B. Quantity Check

1. Retain the empty bags for materials provided in bags to record the amount used.

2. Retain the weight certificates For materials provided in bulk, the weight shall be retained as a record of the amount used.

3. Compare amount of material used with the total area covered to determine the rate of application used.

4. Compare quantity of sprigs used against the total area sprigged.

5. Adjust differences between the quantity applied and the quantity as directed.

3.9 MAINTENANCE

A. Lawn Establishment Period:

1. The establishment period begins on the first day of work under this contract and ends three months after the last day of installation operations.

2. Submit written calendar time period for the lawn establishment period.

    a. When there are multiple lawn establishment periods describe the boundaries of the lawn area covered for each establishment period.

    b. Modify lawn establishment period for inclement weather, shut down periods, or for separate completion dates of areas.

B. Satisfactory Stand of Grass Plants:

1. Evaluate grass plants for cultivar and health when grass plants are a minimum 1 inch (25 mm).

2. Reject stand as unsatisfactory:

    a. If there are less than 6 grass plants /square foot (60 grass plants/sq m).

        1) DO NOT count the annual grass plants when annual seed is applied over the sprigs.

    b. If there are bare spots greater than 9 inch square (230 mm square).

    c. If the total bare spots exceed 2 percent of the total sprigged area.

C. Maintenance During Establishment Period:

1. Eradicating weeds, insects, and diseases.

    a. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

    b. Remedy damage resulting from improper use of herbicides or pesticides.

2. Protect embankments and ditches from surface erosion.

3. Maintain erosion control materials and mulch.

4. Mow, water, and fertilize to establish lawns.

D. Mowing and Trimming:

1. Baseball Field Areas:

Mow grass at regular intervals to maintain at a maximum height of 1 inch (5 cm). Do not cut more than 1/3 of grass blade at any one mowing.

2. Other Turf Areas:

Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of grass blade at any one mowing.

3. Neatly trim edges and hand clip where necessary.

4. Immediately remove clippings after mowing and trimming.

E. Post Hydroseeding or Sprigging Fertilization:

1. Apply the fertilizer as recommended by soil test.

2. Provide a maximum 1 lb/1,000 square foot (8 kg/ha) of available nitrogen to the grass plants.

3. Schedule the application prior to the advent of winter dormancy.

4. DO NOT burn the installed grass plants.

F. Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

G. Repair

1. Repair or reinstall unsatisfactory stand of grass plants.

2. Repair eroded areas with topsoil and reinstall sprigs.

H. Maintenance Record

Submit record of each site visit describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

3.10 CLEANING

A. Keep pavements broom clean and work area in orderly condition.

B. Promptly remove any soil brought on the surfacing by hauling operations.

C. Keep wheels of all vehicles clean to avoid tracking soil on the surfacing of paved areas.

D. Remove excess and waste material from the sprigged areas and dispose off site.

E. Keep pavements broom clean and work area in an orderly condition.

F. Clean and remove surplus materials, temporary structures, discarded materials and debris from work site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

H. Leave the site in a clean, neat, orderly condition.

3.11 PROTECTION

Protect areas immediately upon completion of the sprigging or hydroseeding operation in an area against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.12 INSPECTION AND ACCEPTANCE

Landscape Architect will, upon request, make an inspection to determine acceptance, after completion of installation, maintenance and warranty period.

END OF SECTION

SECTION 03300 - CONCRETE WORK

PART 1 – GENERAL

1.01 SCOPE: Provide concrete work, complete, unless otherwise specified. Provide reinforcing steel& dowel bars for masonry work. Tie bars after they are in place. Pool wall shotcrete and reinforcing is not included.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Excavation and filling, including base course and cushion fill: Section 02200.

B. Furnishing of structural steel base-plates, anchor bolts and other metal accessories for insertion in concrete: Section 05500.

C. Joint sealants: Section 07900.

1.03 CODES AND STANDARDS:

A. Reference Standards and Specifications: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect during unusual climatic conditions.

1. ACI 301, "Specifications for Structural Concrete for Buildings".

2. ACI 318, "Building Code Requirements for Reinforced Concrete".

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

B. Local Codes and Ordinances: Wherever provisions of the International Building Code or the local current ordinances are more stringent than the above specifications and standards, the local codes and ordinances shall govern.

1.04 TESTS:

A. For first batch of concrete placed for each type of concrete and for each 50 cubic yards of each type of concrete placed each day. Samples and tests shall be performed by independent testing laboratory. Contractor shall pay for testing.

B. Each time a batch of concrete is tested, Independent Lab Personnel shall make test cylinders in cylinder molds in accordance with ASTM C31 and prepare them for transporting to independent testing laboratory. One specimen shall be

tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve forlater testing if required.

C. Tests are not required for quantities of concrete less than six yards unless requested by Architect.

D. Contractor may observe all testing performed by the independent testing laboratory.

E. Any re-tests of samples due to failure to meet or exceed minimum requirements shall be paid for by the Contractor.

F. All field samples shall be made by the testing lab personnel who are ACI Certified for samples, and samples shall be properly marked as to date, number and location taken.

1.05 SUBMITTALS:

A Product Data: Submit manufacturer's product data for reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others as required by Architect.

B. Shop Drawings: Submit to the Architect for review prior to installation, shop drawings of all reinforcing steel, including bar cutting lists, construction of forms including jointing, reveals, location and pattern of form tie placement, and construction joint schedule with details. DO NOT reproduce Engineer's Drawings for submittals. This will be cause for rejection.

C. Prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier, for class of concrete, including recent test results substantiating the strength and quality of concrete produced by each mix. Fine and Coarse aggregates shall be evaluated and tested by the contractor for alkali aggregate reactivity in accordance with ASTM C-1260 and ASTM C-1567.

D. Submit weekly reports of all compression, slump, and air content tests from the testing laboratory.

1.06 ENVIRONMENTAL REQUIREMENTS:

A. Allowable Concrete Mix Temperatures: ACI 301-11.

1. Cold Weather: Minimum of 55°F.

2. Hot Weather: Maximum of 90°F.

B. Do not place concrete during rain, sleet or snow, unless protection is provided.

C. Keep accurate thermometer on job site. A slump cone and thermostat shall be on the job at all times during concrete placement.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Form Materials:

1. For Exposed Finish Concrete: Plywood, metal, or other acceptable panel-type materials, to provide continuous, straight, smooth exposed surfaces.

2. For Unexposed Finish Concrete: Use plywood, lumber, metal, or other acceptable material. If lumber is used, it must be dressed on at least 2 edges and 2 sides for a tight fit.

B. Form Coatings: Commercial formulation form coating compound that will not bond with, stain, nor adversely affect concrete surfaces, will not impair subsequent treatments or finishes requiring bond or adhesion, nor impede wetting of concrete surfaces by water or curing compound.

C. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615(S1), grade 60 deformed billet steel bars of sizes as indicated on the structural drawings, free from loose rust, scale and other coatings that may reduce bond.

2. Mesh or Fabric Reinforcement: ASTM A 185, welded wire fabric, of sizes and types as indicated on the drawings.

3. Accessories: Include spacers, chairs, ties, and other devices necessary for properly spacing and fastening reinforcement in place. Use plastic protected reinforcing bar supports conforming to CRSI Class 1 specification for exposed finish concrete.

4. Tie Wires: Soft annealed iron wire not smaller than 18 gage.

D. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I.

2. Normal Weight Concrete Aggregates: ASTM C 33, and the following:

a. Fine Aggregate: Clean, sharp, natural or manufactured sand, free from loam, clay, lumps, or other deleterious substances

b. Coarse Aggregate: Clean, uncoated, processed, locally available aggregate, containing no clay, mud, loam or foreign matter; maximum size of 1-1/2 inches at foundations and 1 inch at slabs

c. Fly Ash: ASTM C618 - Type C or F. DO NOT MIX TYPES. Fly ash shall not exceed 25% of Portland cement by weight. Fly ash may not be used in cold temperature conditions (below 60°F).

d. Fine and coarse aggregates shall be evaluated and tested by the contractor for alkali aggregate reactivity in accordance with ASTM C-1260.

3. Mixing Water: Clean, free from oil, acid, salt, injurious amounts of vegetable matter, alkalies, and other impurities; potable

4. Admixtures:

a. Air Entrained Admixture: ASTM C 260, 5-1/2%, plus 1-1/2% for exterior concrete.

b. Mid-range Water Reducer: ASTM C 494, Type A.

c. Other Admixtures: Do not use other admixtures unless accepted by the Architect.

E. Miscellaneous Materials:

1. Connectors: Provide all metal connectors required for placement in cast-in-place concrete, for the attachment of structural and non-structural members.

2. Expansion Joint Filler: ASTM D 1751, non-extruding premolded material, 1/2 inch thick, unless otherwise noted, composed of fiberboard im-

pregnated with asphalt.

3. Vapor Retarder: Polyethylene film, 10 mil thick, Visqueen or approved equal.

4. Cure/Dustproofing Compound: Conspec #21 is the basis of design. Other products may be acceptable.

5. Concrete Sealer: Conspec "Intraseal" integral concrete sealer & hardener is the basis of design. Other products may be acceptable. Use compatible sealer/hardener with curing compound.

6. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout. Non-Metallic: Master Builders "Set Grout", Sonneborn "Sonogrout", Euclid "Euco-NS", or L & M "Crystex", W.R. Meadows Sealtight CG86 Grout or approved equal.

7. Bonding Agent: Polyvinyl acetate, rewettable type; W.R. Grace "Daraweld C", Sonneborn "Sonocrete", Euclid "Eucoweld", W.R. Meadows Sealtight Intralok, or L & M "Everbond".

8. Epoxy Adhesive: ASTM C881, two component material, suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit project requirements.

9. Waterstops: Waterstop RX. See structural drawings for locations.

2.02 PROPORTIONING OF MIXES:

A. Strength: Concrete minimum ultimate strength at 28 days.

1. Footings: 3,000 psi

2. Interior slab on grade:4,000 psi

3. Pedestals: 4,000 psi

4. Exterior Concrete: 4,000 psi with air entrainment

For mixes receiving air entrainment, refer to Part 2 - Products, Paragraph D, and Sentence 4.

B. Mix Design:

1. Prepare design mixes for each type of concrete, in accordance with ACI 301 and ACI 318, except as otherwise specified.

2. Proportion design mixes by weight for class of concrete required, complying with ACI 211, except as otherwise specified.

C. Provide test results from the concrete supplier for proposed design mix, to establish the following:

1. Gross weight and yield per cu. yd. of trial mixtures.

2. Measured slump.

3. Measured air content.

4. Compressive strength developed at 7 days and 28 days, from 4 test cylinders cast for each 7- and 28-day test, and for each design mix.

D. Submit written reports to the Architect of each proposed design mix and for each class of concrete at least 15 calendar days prior to the start of work. Do not begin concrete production until mixes have been reviewed by the Architect.

E. Use air-entrained admixture in strict compliance with manufacturer's directions.

F. Slump Limits: Not less than three inches and not more than five inches.

2.03 BATCHING AND MIXING: Concrete may be ready-mixed or job- mixed at the Contractor's option, in accordance with the governing building code and with the referenced ACI 318. No hand mixing allowed.

PART 3 - EXECUTION

3.01 FORM WORK:

A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment elevations, and position.

B. Construct forms in accordance with ACI 347, to sizes, shapes, lines and dimen-

sions indicated, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, chamfers, blocking, anchorages and inserts, and other features required in work. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

D. Chamfer exposed corners and edges 3/4 inch unless otherwise indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

E. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

F. Preparation of Form Surfaces: Coat the contact surfaces of forms with a form-coating compound where applicable before reinforcement is placed.

G. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from appropriate trades. Accurately place and securely support items built into form.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Re-tighten forms after concrete placement, if required, to eliminate mortar leaks.

3.02 PLACING REINFORCEMENT: Comply with the Concrete Reinforcing Steel Institute (CRSI) "Recommended Practice for Placing Reinforcing Bars", and as herein specified.

A. Clean reinforcement of loose rust, mill scale, dirt, and other materials or coatings which reduce or destroy bond with concrete.

B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by chairs, spacers, and hangers as required. Set wire ties so ends are pointed into concrete.

C. In all cases, provide required minimum concrete coverage over bar reinforcement.

D. Do not place bars more than 2 inches beyond the last leg of continuous support. Do not use bar supports to hold runways for conveying equipment.

E. Install mesh welded wire fabric reinforcement in as long lengths as practicable, lapping pieces at least one mesh plus 2 inches but in no case less than 8 inches. Offset end laps to prevent continuous laps in either direction. Support mesh using plastic support chairs.

3.03 JOINTS AND INSERTS:

A. Construction Joints: Provide construction joints. Locate and install construction joints so as not to impair the strength and appearance of the structure. Submit construction joint schedule and details to the Architect at least 15 days before proposed pour.

B. Expansion Joints: Provide expansion joints. Do not permit reinforcement to extend continuously through any expansion joint unless noted or detailed otherwise.

C. Inserts: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Properly locate embedded items in cooperation with other trades, and secure in position before concrete is poured. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

3.04 CONCRETE PLACEMENT: Comply with ACI 304, and as herein specified.

A. Pre-Placement Inspection: Before placing concrete, clean and inspect formwork, reinforcing steel, and items to be embedded or cast-in. Notify other crafts in ample time to permit the installation of their work, and cooperate with them in setting such work, as required. Coordinate the installation of joint materials and vapor retarder with placement of forms and reinforcing steel.

B. Vapor Retarder: Apply directly over fill. Lay dry with 6 inch wide dry side laps and end laps. Lay film just before reinforcement is placed and concrete is poured, and protect against punctures. Repair punctures with adhesiveapplied extra sheet before proceeding.

C. Notify the Architect 24 hours before placing any concrete.

D. Conveying: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Provide equipment for chuting, pumping, and pneumatically conveying concrete of proper size and design as to insure a practically continuous flow of concrete at the point of delivery and without segregation of the materials. Keep open troughs and chutes clean and free from coatings of hardened concrete. Do not allow concrete to drop freely more than 10 feet. All equipment and methods used for conveying are subject to the approval of the Architect.

E. Depositing: Deposit concrete continuously or in layers of such thickness that no concrete will be placed on hardened concrete so as to cause seams or planes of weakness. If a section cannot be placed continuously, provide vertical construction joints as specified. Deposit concrete near or in its final location to avoid segregation due to rehandling or flowing, and displacement of the reinforcement.

F. Cold Weather Placing: Comply with the requirements of ACI 306. When the air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees Fahrenheit and not more than 80 degrees at the point of placement.

G. Hot Weather Placing: Comply with the requirements of ACI 305.

H. Compaction: Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3.05 FIELD SAMPLING AND TESTING: The following tests will be performed by an independent testing laboratory provided. Refer to paragraph 1.04 TESTS, for responsibility for payment of tests. Samples for slump and test cylinders will be prepared by the Independent Testing Lab Personnel.

A. Samples:

1. Field samples shall be made and cured in accordance with ASTM C 31, for each concrete strength, at the rate of 4 test cylinders and one slump test for each 40 cubic yards of concrete from each day's pour.

2. Test cylinders as follows:One at 7 days, two at 28 days, and reserve the remaining for testing after a longer period as required by the Architect, if

the 28 day tests do not meet the required strength. In accordance with ASTM C 173 Volumetric Method, or ASTM C231 Pressure Method, make air content check for each set of test cylinders.

3. The taking of samples from small pours of 6 cubic yards or less may be omitted at the discretion of the Architect.

4. Additionally, test slump every 25 cu. yds, recording location for report.

5. When early form removal is requested, field cured cylinders shall be tested at 7 or less days to determine sufficient strength.

B. Testing:

1. Where strength of any group of 3 cylinders or of any individual cylinder fall below minimum compressive strength specified, the Architect shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by Architect from location in structure represented by test specimen or specimens which failed.

2. Specimens shall be secured, prepared, and tested in accordance with ASTM C 42, within a period of 60 days after placing concrete.

3. Concrete shall be considered to meet the strength requirement of this specification if it meets the strength requirements of paragraph 5.3.2 of ACI 318.

4. Should laboratory analysis indicate that the proper concrete mix has not been used by the Contractor, all such concrete poured using the improper mix shall be subject to rejection.

5. The cost of cutting specimens from the structure, patching the resulting holes, and making the laboratory analysis shall be borne by the Contractor.

6. The holes from which the cored samples are taken shall be packed solid with no slump concrete proportioned in accordance with the ACI 211 "Recommended Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have the same design strength as the specified concrete.

7. If any of the specimens cut from the structure fail to meet the requirements outlined in paragraph 5.6.4 of ACI 318, the Architect shall have the right

to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

3.06 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

3.07 SLAB FINISH:

A. After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.

B. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous, smooth finish.

C. Work edges of slabs and joints with an edging tool, and round to 1/4 inch radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

D. Where Broom Finish Concrete is noted: After completion of floating and when excess moisture or surface sheen has disappeared, broom finish by drawing a fine hair broom across the concrete surface, perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the Architect.

3.08 CONCRETE CURING, SEALING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disap-

peared from concrete surface after placing and finishing. Concrete (other than high-early-strength shall be maintained above 50°F (10°C) and in a moist condition for at least the first 7 days after placement. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing and sealing compound, or by combinations thereof, as herein specified.

1. Provide moisture curing by keeping concrete surface continuously wet by covering with water, by water-fog spray, or by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

2. Provide moisture-cover curing by covering concrete surface with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and dustproofing compound on interior and exterior slabs, exterior walks, and curbs as follows:

Apply specified curing and dustproofing compound to concrete slabs only
when temperatures are above 40 degrees F (4 degrees C), when surfaces can
no longer be marred, and when all free water has disappeared. Apply with low pressure spray, soft bristle broom, brush or squeegee. Apply uniformly
in continuous operation using consistent method in accordance with manufacturer's directions. Applysecond coat in similar manner. Maintain continuity of coating and repairdamage during curing period (7 days minimum).

C. Curing Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing until forms are removed. If forms are removed, continue curing by methods specified above as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs and other flat surfaces by application of appropriate curing and sealing compound. Final cure concrete surfaces by moisture-retaining cover, unless otherwise directed.

E. Concrete Sealing: provide concrete sealer and hardener to interior and exterior concrete slabs as follows:

After the curing period, remove any concrete laitance and patch and fix all cracks anddamaged areas. Apply sealer in accordance with manufacturer's directions. Apply only when temperatures are above 40 degrees F (4 degrees C). Avoid contact with glass, aluminum, and polished metal surfaces. If contact occurs, wash immediately with water. Apply second coat in a similar manner.

3.09 PROTECTION:

A. No wheeling, working, or walking on finished surfaces will be allowed for 16 hours after the concrete is placed.

B. Provide plywood or other acceptable protective cover at all traffic areas through-out the job.

C. Protect all exposed concrete floors, steps, and walks from paint, plaster, and other materials or equipment which may mar or damage these surfaces.

3.10 REMOVAL OF FORMS: Do not remove forms until the concrete has attained 67 percent of 28 day strength or a minimum of 4 days. Use a method of form removal which will not cause overstressing of the concrete.

3.11 MISCELLANEOUS ITEMS: Fill in holes and openings left in concrete for the passage of work by other trades after their work is in place. Mix, place, and cure concrete to blend with in-place construction. Provide all other miscellaneous concrete filling required to complete work.

3.12 CONCRETE SURFACE REPAIRS: Repair and patch defective areas with cement mortar of the same type and class as the original concrete, immediately after removal of forms. Cut out honeycomb, rock pockets, voids over 1/2 inch diameter, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface, before placing cement mortar in the same manner as adjacent concrete. Proprietary patching compounds may be used when acceptable to the Architect.

3.13 CLEAN-UP: Do not allow debris to accumulate. Clean up all concrete and cement

materials, equipment and debris upon completion of any portion of the concrete work, and upon completion of concrete work.

3.14 TOLERANCES - CAST-IN-PLACE CONCRETE: Tolerances apply to concrete dimensions and locations only, and shall meet standard tolerances for concrete construction and materials (ACI 117-81).

Tolerances for finished slab surfaces:

Class AA Surface Finish Tolerance: Depressions in floors between high spots shall not be greater than 1/8" below a 10 ft long straightedge.

END OF SECTION

SECTION 03366

WATER-BASED REACTIVE STAINED CONCRETE FLOOR

PART 1 – GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to Work of this Section.

B. Section Includes:
   1. Water-based Reactive stained concrete floor finish.
   2. Sealer.

C. Related Sections:
   1. Division 3 Section “Concrete Work” for general applications of concrete.
   2. Division 7 Section “Joint Sealants” for colored sealant for joints.

1.2 SUBMITTALS

A. Product Data: Manufacturer’s technical data sheets and installation instructions for each product specified.

B. Samples for Initial Selection or Custom Color Samples Provided by Manufacturer per Specifier’s Requirements: Manufacturer’s color charts showing full range of colors available.

C. Qualification Data: For firms indicated in “Quality Assurance” Article, including lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of stain and sealer products shall have minimum 10 years experience in the production of chemical stains.

B. Installer Qualifications: Minimum 3 years experience in staining applications and successfully completed not less than 6 projects comparable in scale and complexity.

C. Substitutions: The use of any products other than those specified shall be considered providing that the Contractor requests its use in writing within 14 days prior to bid date. This request shall be accompanied by:

1. A certificate of compliance from the material manufacturer stating that the proposed products meet or exceed the requirements specified.
2. Documented proof that the proposed material has a 10 year proven record of performance for staining concrete substrates, confirmed by at least 5 local projects that the Architect can examine.

D. Regulatory Requirements:
1. Products shall comply with the United States Clean Air Act for maximum Volatile Organic Compound (VOC) content as specified in PART 2 of this section.

E. Source Limitations: Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

F. [Mockups]:
1. Provide under provisions of Division 1 Section "Quality Control."
2. At location on Project selected by Architect, prepare [mockup] 4 by 4 feet (1.2 by 1.2 m) for review and approval.
3. Construct [mockup] using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in [mockup] panels.
4. [Mockup] shall be stained and sealed by the individual workers who will actually be performing the work for the Project.
5. Obtain written approval of the [mockup] from Architect before start of work.
6. Retain approved [mockup] through completion of the Work for use as a quality standard for finished work.
7. Approved [mockup] may become part of the completed Work if undisturbed at time of Substantial Completion.
8. Remove [mockup] when directed.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.

B. Store specified products in conditions recommended by the manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50^{o} and 90^{o}F during application and at least 48 hours after application.

B. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

1.6 PRE-JOB CONFERENCE

A. One week prior to the placement of Water-based Reactive Stain a meeting will be held to discuss the project and application of materials.

B. It is suggested that the Architect, General Contractor, & Subcontractor be present.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Water-based Reactive Stains: A ready-to-use, penetrating, reactive staining product that chemically bonds with cured concrete or cementitious toppings to produce translucent color effects.
   1. Colors: As selected by Architect.

B. Sealers:
   1. A premium-quality, one-component, clear, acrylic-polyurethane sealer resistant to staining, abrasion and ultraviolet (UV) radiation.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Concrete:
   1. Newly placed concrete shall be sufficiently cured to allow concrete to become reactive, minimum 28 days.
   2. Do not use liquid curing materials. Cure concrete flatwork with new, unwrinkled, non-staining, high quality curing paper. Do not overlap curing paper.
   3. Surfaces shall be cured using the same method and different sections (pours) chemically stained when the concrete is the same age.
   4. Immediately prior to chemically staining, thoroughly clean the concrete. Sweep surfaces, then pressure wash or scrub using a rotary floor machine. Use suitable,

high-quality commercial detergents to facilitate cleaning. Rinse surfaces after cleaning until rinse water is completely clean. Allow floor to dry completely prior to application of floor stain.

5. Concrete surfaces must be uniformly slip-resistant and profiled to meet a Concrete Surface Preparation (CSP) profile of 1-2 per ICRI guidelines.
6. Some concrete may require abrading to open the surface and make it sufficiently penetrable. In these instances the concrete surface must be sanded using an 60-80 mesh-sanding screen or a grit brush. After sanding, all residue must be removed by power vacuuming. The surface should then be pressure washed or scrubbed using a rotary floor machine.
7. For preparation, the sandblaster should be capable of producing a light, uniform sandblast and be equipped with a dust collector.
8. For preparation, the pressure washer should be equipped with a fan tip and have a minimum pressure capability of 4000 psi (14 MPa). Hot water capability may facilitate cleaning of existing concrete.
9. Acid washing may be required when the above surface preparation does not yield adequate penetration or if there are excessive alkali deposits or surface discoloration. The reacted residue must be abraded using a low-speed floor machine equipped with a 60 mesh screen or a grit brush and then thoroughly rinsed until the rinse water is clear and free of solids, a minimum of two times. After rinsing, neutralize any remaining acid residue by washing with a solution of baking soda (sodium bicarbonate) and water. (Test pH of floor should be 7 or higher.)

B. Scoring: Score decorative jointing in concrete surfaces 1/8-inch (3.2 mm) deep with diamond blades. Rinse until water is completely clean.

3.2 APPLICATION OF WATER-BASED REACTIVE STAIN

A. Concrete surfaces shall be dry and properly prepared as described above. Protect surrounding areas from over-spray, run-off and tracking. Divide surfaces into small work sections using wall, joint lines, or other stationary breaks as natural stopping points.

B. Apply water-based reactive stains full strength (undiluted) at the coverage rate recommended by the manufacturer and use application equipment described in the manufacturer’s printed technical literature. The color of the liquid chemical stain has no resemblance to the final color produced on the concrete substrate.

C. Apply water-based reactive stain to the substrate with an airless sprayer or HVLP sprayer.

D. Reaction time depends on wind conditions, temperatures, and humidity levels.

E. The second coat, if required, should be applied after the first coat has dried sufficiently and can be walked on without damage, normally 2-4 hours after application depending on temperature and humidity. A third coat could be applied 2-4 hours after the second coat.

3.4 APPLICATION OF SEALER

A. Concrete substrate shall be completely dry.

B. Sealer shall be produced by the water-based reactive stain manufacturer.

C. After the final Stain application has dried sufficiently, normally 8-24 hours at 75^{o} F (24^{o} C) and 50% relative humidity, remove all contaminates from the surface by dry mopping if required.

D. Apply sealer according to manufacturer's written instructions at a rate of 300 to 500 square feet per gallon per coat. Two coats are required.

E. Maintain a wet edge at all times.

F. Allow sealer to completely dry before applying additional coats.

G. Apply second coat of sealer at 90^{o} to the direction of the first coat using the same application method and rates.

H. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.5 PROTECTION

A. Protect floor from traffic for at least 72 hours after final application of sealer.

3.6 MAINTENANCE

A. Maintain water-based reactive stained and sealed floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high-quality commercial detergent. Maintain interior floors that require polishing by using a compatible, premium-grade, emulsion-type, commercial floor polish, following manufacturer's instructions and safety requirements.

END OF SECTION

SECTION 04110 - PRE-BLENDED MORTAR

PART 1 - GENERAL

1.01 SCOPE: Furnish labor and materials to provide pre-blended mortar required to complete masonry work shown in Drawings and Specified.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Masonry Accessories: Section 04150

B. Brick Masonry: Section 04210

C. Concrete Unit Masonry: Section 04200

D. Steel Doors & Frames: Section 08110

1.03 REFERENCES:

A. ASTM C91-91, American Society for Testing Materials, Specification for Masonry Cement.

B. ASTM C144-91, American Society for Testing Materials, Specification for Aggregate for Masonry Mortar.

C. ASTM C150-92, American Society for Testing Materials, Specification for Portland Cement.

D. ASTM C207-91 (1992), American Society for Testing Materials, Specification for Hydrated Lime and Masonry Purposes.

E. ASMT C270-92, American Society for Testing Materials, Specification Mortar for Unit Masonry.

F. ASTM C780-91, American Society for Testing Materials, Test for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

1.04 DELIVERY, STORAGE AND HANDLING:

A. Provide pre-blended mortar manufacturer's dispensing equipment for storage and controlled dispensing of the dry pre-blended mortar mixture.

B. Deliver pre-blended mortar in reusable packages. Mark packages with the pre-blended manufacturer's name.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS:

A. Portland Cement: ASTM C150, Type I (and Type II). (Use Type II Portland cement for masonry in contact with earth. Use Type I for all other masonry work.)

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91.

D. Sand: ASTM C144. Aggregate for mortar joints less than 1/4" wide shall pass a No. 16 sieve.

E. Mortar Pigments: Synthetic iron and chromium oxides compounded for use in mortar mixes. Provide integral mortar color for brickwork. Submit samples.

F. Water: Clean, potable and free of deleterious amounts of acids, alkali and organic materials.

2.02 MORTAR:

A. Mortar shall be a pre-blended mortar manufactured by Spec Mix. All cementitous materials, aggregate and admixtures shall be blended in the factory under controlled conditions, and the mortar mix shall only require the addition of water at the jobsite.

B. Proportions and Strength:

1. Mortar shall conform to the "Proportion Specifications" of ASTM C270.

2. Mortar shall be a Portland cement-lime mortar.

3. Use no admixtures, salts or anti-freeze compounds.

4. Use Type S mortar for masonry work in contact with earth and elsewhere where indicated on the Drawings. Use Type N mortar for all other masonry work.

5. Mortar for exposed brickwork shall be colored. Mix mortar pigments at the rate of not more than 25 pounds of pigment per sack of Portland cement or 10 pounds of masonry cement. Exact color shall be as selected by the Architect. Colored mortar shall meet all specified requirements for mortar.

C. Mixing:

1. Add water to bring mortar to proper consistency for use. Mix for at least 4 minutes after water is added. Thoroughly clean mixer after discharging each batch.

2. Use mortar within 2-1/2 hours after initial mixing, and discard mortar not used within this time. Mortar may be retempered by adding water and re-mixing at any time within 2 hours after its initial mixing.

D. Waterproof Admixtures: hydrocide or Omicron, mixed as per manufacturer's instructions and incorporated in all mortar used on exterior of the Building and areas in contact with the earth or fill.

2.03 SOURCE QUALITY CONTROL:

A. Mortar Mix Designs:

1. The Contractor shall employ an independent testing laboratory to test the proposed aggregate and design mortar mixes for each type of mortar to be used.

2. Test aggregate for conformance to ASTM C144 and these specifications.

3. Test mortar for water retentivity and 28 day compressive strength in accordance with ASTM C270.

4. Submit aggregate test reports and mix designs to the Architect and Structural Engineer in duplicate for approval at least 14 days prior to beginning masonry work. Lay no masonry until the aggregate test reports have been reviewed and mix designs approved by the Architect.

5. The approved mix designs shall be used as long as aggregate characteristics remain unchanged. Upon significant changes in aggregate, prepare new mix design and submit copies to the Architect.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL:

A. Mortar Tests: The Contractor shall employ an independent testing laboratory to test the mortar in accordance with ASTM C270. Make one test for each type of mortar and each 500 square feet of wall constructed with that mortar.

B. Submit test reports to the Architect, Structural Engineer, and General Contractor.

END OF SECTION

SECTION 04150 - MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE: Furnish materials and labor necessary to complete masonry work indicated in Drawings and specified.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Unit Masonry: Section 04200

B. Brick Masonry: Section 04210

C. Masonry Water Repellant: Section 07150

1.03 SUBMITTALS: Prior to the delivery of any masonry accessories to the job site, technical data describing the herein specified materials shall be delivered to the Architect for approval. No materials shall be delivered to the job site until submittals have been approved in writing.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:

1. Masonry Joint Reinforcement: Shall be factory fabricated from zinc-coated cold-drawn steel wire, ASTM A 823. Reinforcement shall consist of the two or more deformed longitudinal wires minimum size No. 9 gauge, weld connected with minimum No. 9 gauge cross wires, forming a truss or ladder design.

a. Zinc coating, ASTM A 116 shall be Class 1, except that cross wires used for cavity wall ties shall be Class 3. Out-to-out spacing of longitudinal wires shall be approximately 2 inches less than the normal width of the block or the way in which it is placed. Distance between welded contacts of cross wires with each longitudinal wire shall not exceed 16 inches.

b. Joint reinforcement shall be furnished in flat sections 10 to 20 feet in length, except that factory-formed corner reinforcements and other special shapes may be less in length.

c. Provide stainless steel reinforcing and dowel pins where in contact with limestone.

d. Reinforcing for casting into lintel blocks shall be preformed steel bars sized as shown in the drawings and in lengths beyond complete length of lintel span as shown on structural.

e. Provide Brick Cavity Wall Drainage System: Mortar Net as manufactured by Mortar Net USA, Ltd., 90 percent open weave mesh, dovetail configuration with continuous bottom strip. Mortar Net USA Limited, which is located at: 326 Melton Rd. ; Burns Harbor, IN 46304; Toll Free Tel: 800-664-6638; Phone: 219-787-5080; Fax: 219-787-5088; Email: leads@mortarnet.com; Web: www.mortarnet.com

PART 3 - EXECUTION

3.01 WORKMANSHIP:

A. Metal masonry-course reinforcing shall be used in all partitions, spaced 16 inches o.c., vertically, joints lapped 6 inches. Place reinforcing in first bed joint above and below all concrete slabs and wall openings.

B. Anchors for tying masonry to walls shall be 18 GA x 7/8” wide galvanized brick ties spaced @ 16” on center both vertically and horizontally and anchored with one 8d galvanized ring shank nail.

C. Masonry joint reinforcement shall be placed so that longitudinal wires are located over face-shell mortar beds and are fully embedded in mortar for their entire length with minimum mortar cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations.

D. Reinforcement at openings shall extend not less than 24 inches beyond the end of sills or lintels or to the end of the panel if the distance to the end of the panel is less than 24 inches. Reinforcement shall not be continuous through a control joint or an expansion joint.

E. Reinforcement shall be lapped 6 inches or more. Factory-fabricated sections shall be installed at corners and wall intersections.

F. Reinforcing metal ties, and anchors shall be protected from contact with soil and before being placed shall be free from loose rust and other coatings that will destroy or reduce the bond.

END OF SECTION

SECTION 04200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SCOPE: Furnish labor and materials necessary to complete concrete masonry work as indicated in seismic design category D.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Masonry Accessories: Section 04150

B. Brick Masonry: Section 04210

C. Joint Sealants: Section 07900

D. Dampproofing & Waterproofing: Section 07150

1.03 QUALITY ASSURANCE:

A. Codes and Standards: Provide material and work complying with referenced codes, regulations and standards.

B. Manufacturer: Obtain each type of unit from one manufacturer, cured by one process, and of uniform texture and color.

1.04 SUBMITTALS:

A. Certification: Submit certification that each type of unit complies with specified requirements.

B. Manufacturer's Data: Submit manufacturer's technical data and installation instructions for insulation material.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver masonry materials to project in undamaged condition to site being in compliance with specified ASTM requirements for chippage, cracks, and dimensional tolerances.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion and other causes.

C. Store cementitious materials off ground, under cover and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained.

E. Store masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.06 JOB CONDITIONS:

A. Protect masonry materials during storage and construction from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials. Do not use metal reinforcing or ties having loose rust or other coatings, including ice, which will reduce or destroy bond.

B. During erection, cover top of wall with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

D. Prevent grout or mortar from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with masonry. Protect sills, ledges and projections from droppings of mortar.

E. Do not lay masonry when the temperature of outside air is below 40EF, unless means are provided to heat and maintain temperature of masonry materials and protect completed work from freezing. Protection shall consist of heating and maintaining temperature of masonry materials to at least 40EF, and maintaining an air temperature above 40EF on both sides of masonry for at least 48 hrs.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS:

A. General:

1. Comply with referenced standards and other specified requirements for each type of masonry unit required.

2. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding, cap, cove, bullnose and other specialconditions.

B. Concrete Block: Provide units complying with characteristics specified below for Grade, Type, face size, exposed face, and weight classifications.

1. Grade N.

2. Size: Manufacturer's standard units with nominal face dimensions of 16" long X 8" high X thicknesses indicated.

3. Type I, moisture-controlled units.

4. Hollow Loadbearing Block: ASTM C 90; lightweight, except use normal weight block for all work below grade.

5. Curing: Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C 90 Type I requirements.

2.02 MORTAR AND GROUT MATERIALS:

A. Portland Cement: ASTM C150 Type I, except Type III may be used for cold weather construction.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregate for Mortar: Sand, conforming to ASTM C144 or ASTM C404, Size No. 2.

D. Aggregate for Grout: ASTM C404, Size No. 8 or Size No. 89.

E. Water: Clean, drinkable.

F. Admixtures: When concrete masonry units manufactured with integral water repellent admixtures are specified, provide mortar with “Dry-Block” mortar admixture as recommended by admixture manufacturer, W.R. Grace & Co.

2.03 HORIZONTAL JOINT REINFORCING:

A. Provide welded wire units in straight lengths of not less than 10’ with matching corn and tee units. Fabricated from cold-drawn steel wire complying with ASTM A82 with deformed continuous side rods and plain cross rods. The unit width is 1 ½” to 2” less than the thickness of wall. Provide manufacturer’s standard mill galvanized finish. Use ladder or truss design as follows:

1. 10” CMU, use 2-3/16” side rods with 8” vertical spacing.

2. At CMU walls, use 2#5 horizontal in bond beam @ 4’-0” on center.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine the areas and conditions under which masonry is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. CMU: Do not wet concrete masonry units.

B. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

3.03 CONSTRUCTION TOLERANCES:

A. Variation from Plumb: For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story of 20' maximum, nor 1/2" in 40' or more.

B. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 3/4" in 40" or more.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.

3.04 INSTALLATION, GENERAL:

A. Thickness: Build composite/cavity walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

B. Build chases and recesses as indicated or required for the work of other trades. Provide not less than 8" of masonry between chases or recess and jamb openings, and between adjacent chases and recesses.

C. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

D. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to fit adjoining work neatly. Use full-size units without cutting wherever possible.

3.05 LAYING MASONRY WALLS:

A. Lay walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other work.

B. Lay concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with grout. Lay CMU in running bond with vertical joint in each course centered on units above and below.

C. Build-in items specified under this and other sections of this specification. Fill in solidly with masonry around built-in items. Fill space between hollow metal frames and masonry solidly with mortar.

D. Joints: Lay walls with 3/8" joints. Use mortar mix as dry as practicable and compress joints as much as possible to produce a dense tight joint.

1. Concealed joints: Strike flush.

2. Exposed CMU joints: Tooled.

3.06 HORIZONTAL JOINT REINFORCING:

A. Reinforce walls with continuous horizontal reinforcing. Fully embed longitudinal side rods in mortar for their entire length. Lap reinforcement a minimum of 6" at ends of units. Do not bridge control joints with reinforcing.

Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcing as directed by the manufacturer for special conditions. Space reinforcing 16" o.c. vertically.

B. Reinforce masonry openings greater than 12" wide with horizontal joint reinforcing placed in 2 horizontal joints approximately 8" apart, both immediately above the lintel and below the sill. Extend reinforcing a minimum of 2' beyond jambs of the opening bridging control joints where provided.

3.07 CONTROL AND EXPANSION JOINTS: Install vertical expansion and control joints. Build-in related items as masonry work progresses. Refer to Section 07900 for sealants.

3.08 REPAIR, POINTING AND CLEANING:

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended.

Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of placement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. Clean exposed CMU masonry by dry brushing at end of each day's work and after final pointing to remove mortar spots and drippings.

D. Clean other surfaces affected by overspray.

END OF SECTION

SECTION 04210 - BRICK MASONRY

PART 1 - GENERAL

1.01 SCOPE:

A. Furnish materials and labor necessary to complete masonry work indicated in Drawings and specified.

B. Work includes installation of items or materials furnished by other trades when required to be built into masonry work.

1. Sheet metal flashings, counterflashings, through- wall flashings and like items of moisture protection built into masonry construction.

2. Loose lintels and/or bearing plates anchored to or bearing upon masonry construction.

3. Hollow metal door and window frames anchorage members.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Pre-Blended Mortar: Section 04110

B. Masonry Accessories: Section 04150

C. Concrete Unit Masonry: Section 04200

D. Masonry Water Repellant: Section 07150

1.03 HANDLING AND STORAGE:

A. Handle, transport and deliver masonry in such manner as to prevent soiling, mutilation, chipping or breaking.

B. Store masonry on platforms raised above grade. Protect from damage by dirt, mud, grease, weather or staining materials with suitable protective cover.

PART 2 - PRODUCTS

2.01 MATERIALS:

Face Brick: The Contractor shall include in his bid the costs of $450 per thousand for modular face brick Cost to include brick, sales tax, delivered, and unloaded on the job site. Any unused portion of the allowance shall be refunded to the Owner. Face Brick shall be in accordance with the requirement of A.S.T.M. C-62 specifications and shall meet SW grade requirements. Brick to be selected by Architect.

PART 3 - EXECUTION

3.01 WORKMANSHIP:

A. For actual cutting and placing of all masonry work, use only skilled masons who are thoroughly experienced with the materials and methods specified and thoroughly familiar with the design requirements.

B. Lay masonry work plumb and true to lines, with level, accurately spaced coursing. Work masonry to course vertically and horizontally. Break each course joint with course below, keeping head joints of alternate courses in straight, vertical alignment. Lay corners and reveals plumb and true.

C. Make all cuts in exposed masonry walls with masonry saw. Minimum length of any cut unit in exposed masonry work: one-half unit length. A masonry saw with a minimum of two spare blades shall remain on the job until all masonry work has been completed.

D. Wet clay or shale brick 3 to 24 hours before laying if absorption of area immersed in 1/8 inch of water for one minute exceeds .025 ounces per square inch. Do not place freshly wetted brick having water or frost on surface in any walls.

E. Work joints in brick to nominal 3/8 inch thickness. Compact mortar tightly against masonry on both sides of joint. Tool head joints first.

F. Weep holes shall be provided 16 inches on center in mortar joints on exterior of cavity walls. Weep holes shall be kept free of mortar and other obstructions. Form weeps with ‘Mortar Net’ or equal.

G. Extreme care shall be taken so as not to lay any brick in partitions or walls which will show any chipped or broken edges.

H. Unless otherwise required, fill solidly with mortar all spaces in and around metal door frames and other built-in items. Where possible, build in work required to be built-in with masonry, including anchors, wall plugs and accessories, as

erection progresses. All patching of masonry required to accommodate built-in items shall be done in a manner to match original work.

I. Protect masonry against freezing at least 48 hours after laying. Unless adequate precautions are taken to prevent freezing, do not lay masonry when temperature is below 40 degrees F. Post accurate thermometer directly adjacent to work in progress for temperature references.

J. Protect tops and top 2 feet of each side of masonry walls with strong waterproof membrane securely anchored, except when masonry work is in progress or permanent protection is provided otherwise.

3.02 CUTTING AND PATCHING:

A. Consult other trades in advance, provide for installation of such related work to avoid cutting and patching whenever possible. Supervise any subsequent cutting of masonry performed by other trades, and perform any necessary patching in connection therewith.

B. Step back unfinished work for joining with new work. Toothing may be resorted to only when so approved. Before new work is started, remove loose mortar, expose joints and wet thoroughly at least twelve hours before laying new work.

3.03 CLEANING AND POINTING:

A. Progress work in as clean a manner as possible. Remove excess materials and mortar droppings daily. Remove mortar droppings on connecting or adjoining work before its final set.

B. On completion, point exposed masonry, fill holes, and joints, remove loose mortar, cut out defective joints and re-point where necessary. After pointing has thoroughly set, clean down all surfaces using stiff brushes, approved masonry cleaning detergents, and water, or other approved cleaning methods. No acids shall be used. Avoid staining masonry or damage to other work during cleaning operations.

END OF SECTION

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Structural steel work, complete at the Aquatic Center. All steel members, connections, miscellaneous plates, and bolts shall be hot-dip galvanized and epoxy painted in a duplex system.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Touch-up and repair painting of steel, Section 099000.

B. Metal fabrications and miscellaneous metals, Section 055000.

C. Sprayed Fireproofing, Section 072510.

1.3 SUBMITTALS:

A. Shop Drawings: Submit shop drawings prepared by or under supervision of a qualified professional engineer;

1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of the members, and details, schedules, procedures and diagrams showing the sequence of erection. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.

2. Qualification Data: Certificates to indicate compliance with quality assurance requirements.

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with the provisions of the following:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. AISC "Specifications for Structural Steel Buildings", including "Commentary".

3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections.

4. AWS D1.1 "Structural Welding Code - Steel".

B. Qualifications For Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Testing and Inspection:

1. Contractor shall employ an independent testing agency, acceptable to Owner and Architect, to inspect welded and bolted connections. The following items will be included in testing agency inspections:

a. Visual inspection of welded and bolted connections for quality.
b. Check by ultrasonic (or other means approved by Architect) minimum of 10% of beam to beam/column and column to column full penetration welds if full penetration welds are indicated on contract drawings. After 2 beam (1 top and 1 bottom flange each) welds have been placed by each welder, the testing agency shall check and approve these welds before additional welds are placed.
c. Test approximately 10% of high strength bolts for correct nut tightness.
d. In addition to visual inspection, inspect and test field-welded shear connectors in compliance with AWS D1.1 requirements.

2. Correct as directed, at Contractor's expense, connections that are found unsatisfactory to testing agency.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts or nuts become dry or rusty, clean and relubricate before using.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Structural Steel:

1. W-Shapes: ASTM A 992, if unavailable, ASTM A572, Fy=50 ksi.

2. Plates And Bars: A 36.

B. Tube Sections:

1. Cold-Formed; ASTM A500, Grade B, Fy=46 ksi.

2. Hot-Formed; ASTM A501, Fy=36 ksi.

C. Steel Pipe: ASTM A 53, Type E or S, Grade B, or ASTM A 501.

D. Shear Connectors: ASTM A 108, 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

E. Anchor Rods, Bolts, Nuts, and Washers:

1. Unheaded Anchor Rods: ASTM A 36.

2. Headed Bolts: As indicated.

a. ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
b. ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
c. ASTM A 490, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.

3. Washers: ASTM A 36.

F. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-headed bolts; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish as indicated:

a. Plain, uncoated.
b. Hot-dip zinc coating, ASTM A 153, Class C.
c. Mechanically deposited zinc coating, ASTM B 690, Class 50.

G. Electrodes For Welding: E70XX, in compliance with AWS Code.

H. Non-Metallic Shrinkage-Resistant Grout: Conspec "100 Non-Shrink Grout (Non-Metallic)", Euclid "Euco N.S.", L & M "Crystex", MasterBuilders "Masterflow 713", W. R. Meadows "Sealtight 588 Grout", or approved equal; comply with CRD-C-621.

I. Shop Paint: Lead free, alkyd primer; Tnemec 10-99 Series, Southern Coatings Enviro-Guard 1-2900, or approved equal, meeting performance requirements of TT-P-86, Type I and passing ASTM B 117 after 500 hours with no blistering, cracking, softening, delamination, or rust creepage at scribe and rusting at edges. For steel members exposed to weather and pool moisture, use TNEMEC 10-66 epoxy paint or equal.

J. Galvanizing: Apply zinc coating by hot-dip process to structural steel members exposed to weather or moisture according to ASTM A 123. Vent holes shall be provided by the steel fabricator. Fill vent holes and grind smooth after galvanizing.

K. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel work, complying with SSPC-Paint 20.

2.2 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.

2. Where shop finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Bolt field connections, except where welded connections or other connections are indicated.

a. Provide high-strength threaded fasteners for principal bolted connections, except where otherwise indicated.

2. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts".

C. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

D. Steel Wall Framing: Select members that are true and straight for fabrication of steel wall framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end of welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

F. Holes For Other Work: Provide holes for securing other work to structural steel framing and for passage of other work through steel framing members, as indicated on final shop drawings.

1. Provided threaded nuts welded to framing and other specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 SHOP PAINTING:

A. Shop paint all structural steel, except as follows:

1. Members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on the exposed portions and the initial 2" of embedded areas only.

2. Members to be welded.

3. Members to receive sprayed fireproofing.

4. Top of steel beams where headed studs will be attached by welding through steel deck.

B. Surface Preparation: Before painting, thoroughly clean all surfaces of all grease, rust, welding droppings and loose mill scale by methods conforming to SSPC-SP-1 and SSPC-SP-3. After erection, wire-brush and touch-up welded or abraded areas. Touch-up with primer.

C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions and at a rate to provide a uniform dry film thickness of 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges and all exposed surfaces.

D. Duplex Systems: Painting over hot-dip galvanized steel. Steel is not quenched after galvanizing and any coating imperfections are remedied. Epoxy-Polyamide Cured paint is recommended. Consult the paint manufacturer for proper surface preparation.

PART 3 - EXECUTION

3.1 ERECTION:

A. Brace and guy members until final connections are made. Structure is not stable until all members, connections, decking, slabs, bracing, and other structural components are in place and secured.

B. Setting Bases and Bearing Plates: Clean bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom of base and bearing plates.

1. Set loose and attached bearing plates and bearing plates for structural members on wedges or other adjusting devices.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

4. For proprietary grout materials, comply with manufacturer's instructions.

C. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clear bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

2. Level and plumb individual members of structure within specified AISC tolerances.

D. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

1. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Do not enlarge holes in members by burning or by using drift pins.

3.2 TOUCH-UP PAINTING: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on structural steel is included in Section 099000.

END OF SECTION

SECTION 05500 - MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE:

A. Furnish materials, labor, and equipment necessary to complete all miscellaneous metal work indicated in Drawings and specified.

B. The American Institute of Steel Construction Specifications for Design, Fabrication and Erection of Structural Steel Buildings, latest edition, form part of this Specifications. DO NOT reproduce engineers' drawings for submittals. This will be cause for rejection.

1.02 SHOP DRAWINGS: Submit shop drawings for each fabricated metal item specified herein or required by Drawings. Show pertinent details of construction and connection to other work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Miscellaneous Steel: Shall conform to ASTM Standard Specification for Structural Steel for Bridges and Building, latest edition. Steel shall be fabricated and primed before delivery to site. Exposed fastening shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied.

B. Arc-Welding Electrodes: Shall conform to requirements of American Welding Society "Specifications for Iron and Steel Arc-Welding Electrodes", latest edition.

C. Bolts and Welded Threaded Studs: All bolts and welded threaded studs required to receive wood blocking, plates, etc., that fasten to steel members shall be furnished under this Section. Holes in steel to receive bolts shall be punched by steel fabricator. Bolts, nuts and washers for structural steel joints shall be ASTM-325. Bolts and/or welded threaded studs for bracing, secondary members and wood blocking shall be ASTM A-307.

D. Fastenings: Best quality, grade, suited for purpose used. Provide through type bolts with concealed plate washers or as indicated on the Drawings.

2.02 COORDINATION: HOLES FOR ATTACHMENT OF WORK OF OTHER SECTIONS:

A. Where work of this Section is required to be fitted to work of other Sections and other contracts, coordinate such work accordingly.

B. Provide holes, slots, indicated on Structural, Architectural Drawings in or through surfaces of items provided under this Section, number of holes, slots; as indicated in the Drawings. Sizes, exact location of holes; as approved on shop drawings. Space holes, position and align members exactly as required to provide proper conditions for attachment of work of other contracts.

2.03 SHOP PAINTING:

A. Thoroughly clean surfaces before painting. Paint ferrous metals one coat of rust inhibitive primer. Similarly paint contact surfaces before assembly.

B. Shop coat shall be free from runs, blisters, and other defects. Thoroughly dry shop coat before delivery. Touch up bear spots.

2.04 FIELD PAINTING:

A. After assembly, erection, paint exposed parts of rivets, bolts, screws, welds and the like, also any parts of surface where shop painting has been damaged, with one coat of rust inhibitive primer. Paint rivets as soon as driven; dip bolts that are to remain in place. Paint nuts, parts that will be inaccessible after erection.

B. All steel remaining in contact with aluminum or aluminum cladding shall be coated with two separate coats of rust inhibitive primer, or approved equal. No bare spots.

2.05 FABRICATION: Shop assemble work when possible, ready for erection as per best practices of trade; employ only mechanics skilled in trade.

PART 3 - EXECUTION

3.01 EXECUTION:

A. Execute work as per approved shop drawings.

B. Defective materials or workmanship will be rejected; remove, replace such rejected work.

C. Where any construction or materials are indicated, but materials, sizes are not definitely noted, conform to materials, sizes indicated, described for similar construction, as approved. Provide materials, workmanship necessary to meet special conditions.

D. Provide all angles, channels, plates, bolts, nuts, washers, screws, anchors, straps, brackets, miscellaneous supports, and the like, indicated, required for performance of work as whole, except for such items specifically provided under other sections, contracts.

E. Connections: Welded, riveted, bolted or screwed in accordance with best practices. Exposed fastenings: of which same matching material, color, finish as metal in which they occur. Weights of connections: of adequate strength to sustain safely and withstand stresses, strains to which they will be normally subjected, equivalent to strength of material to be jointed. All work exposed to the exterior shall be Hot-Dip Galvanized.

1. Structural steel framing connections, parts, accessories: conform to AISC Standards, latest edition.

2. Make jointing, intersections of metals accurate, tight, true; securely fasten. Abutting bars, generally: shouldered, headed, doweled, pinned.

3. Where applicable, make threaded connections tight to threads are concealed. Cut off exposed bolt, screw ends; dress flush with nuts, other adjacent. Nick bolt threads to prevent loosening of nuts.

4. Insulate metal in contact with dissimilar metal to prevent corrosion, in approved manner.

5. Execute drilling, tapping, cutting, fitting, boxing as required for proper installation of work under this Section, to accommodate work of other Sections, Contracts.

6. Galvanizing: of heavy zinc coating by hot dipping process, carrying minimum of two ounces of zinc per square foot of metal surface after galvanizing. Zinc coating: smooth, or reasonable uniform thickness, free from dross, uncoated spots.

F. All Work built into or adjacent to masonry shall be Hot-Dip Galvanized of form, strength, & extension required for proper anchorage. Provide anchors, fastenings and the like as indicated, required; where details are not indicated, specified, they shall conform to standard approved practice using approved type fastenings. Fastenings to wood plugs set in masonry will not be permitted.

G. Supports: Provide required supporting members, fastenings, framing, hangers, anchors, brackets, lugs, sleeves, straps, bolts and the like required to set, connect, secure work rigidly, properly to concrete, steel, masonry, wood framing, or other construction.

END OF SECTION

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SCOPE: Perform all work required to complete rough carpentry work indicated and furnish all items necessary for proper installation. In general, this work includes the following:

A. Rough framing, blocking, etc.

B. Braces, stripping, grounds, and nailers indicated or necessary to install toilet room accessories, countertop braces, countertops, and to receive or back work of other trades

C. Pre-manufactured wood roof trusses

D. Plywood wall sheathing

E. Plywood roof sheathing

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Concrete Masonry Units: Section 04200

B. Pre-manufactured Wood Roof Trusses: Section 06160

C. Structural Glued Laminated Beams: Section 06185

D. Commercial Building Wrap: Section 07274

E. Fiber Cement Ceiling/Soffit Panels: Section 07462

1.03 QUALITY ASSURANCE:

A. Grading Marks: Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification. Submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

B. Wood Preservative Treatment: Label each piece of pressure treated lumber and plywood with the Quality Control mark of the American Wood PreserversBureau showing compliance with the appropriate standard.

1.04 SUBMITTALS: Product/Data: Submit copy of manufacturer's technical data to evidence compliance with these specifications.

1.05 PRODUCT HANDLING:

A. Keep carpentry materials dry during delivery, storage and handling. Store lumber and plywood in stacks for air circulation - protect stack bottoms against contact with damp surface. Protect exposed materials against weather.

B. Do not store dressed or treated lumber or plywood outdoors.

PART 2 - PRODUCTS

2.01 SOFTWOOD: Comply with the standards of SPIB "Standard Grading Rules for Southern Pine Lumber".

A. For structural light framing 2" to 4" thick, 2" to 12" wide, use KD, S4S, Southern Pine No.2.

B. For light framing 2" to 4" thick, 2" to 12" wide use KD, S4S Southern Pine Construction Grade.

C. Moisture Content: Structural lumber 2" or less and boards, 19% maximum; finish lumber and millwork, 12% maximum.

D. Exterior Grade Plywood Roof Sheathing: Min.1/2” APA rated, oriented strand board (OSB), span index 40/20

E. Exterior Grade Plywood Wall Sheathing: Min 1/2” APA rated, oriented strand Board (OSB), span index 40/20

F. 2x6 Solid Timber Decking by Structural Wood Systems or equal.

2.02 ROUGH HARDWARE: Hot-dip galvanized nails, metal connectors, bolts, nuts, screws, washers, staples, and other fasteners (except as specified or noted otherwise); hot-dip galvanized steel.

2.04 WOOD PRESERVATIVE TREATMENTS:

A. Preservative Treatment by Pressure Process: Pressure treat above-ground items

with micronized copper azole (MCA) or approved equal. After treatment, kilndry lumber to a maximum moisture content of 19 percent. Stain all the surfaces.

Treat and stain indicated items and the following:

1. Nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

3. Wood floor plates installed over concrete slabs directly in contact with earth.

4. Wood decking 2x6s.

Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment.

B. Fire Retardant Treated Wood (FRTW): Have a flame spread index of 25 or less (Class A) when tested in accordance with ASTM E84 or UL 723 and meet the performance requirements of AWPA U1 & AWPA C20/C27. Pressure treated, exterior type, after treatment, kiln dry lumber to a maximum moisture content of 19 percent and plywood to 15 percent. No increase in the listed classification when subjected to the Standard Rain test (ASTM D 2898). Include 2x4, 2x6 studs and plywood sheathing.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Securely attach carpentry work to substrate by anchoring and fastening as indicated or as required by recognized standards.

C. Use common wire nails, except as otherwise indicated or specified. Select fasteners of size that will not penetrate members where opposite side will be

exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

D. Coordinate installation of post bases with concrete and masonry work. Install bases accurately, true, plumb, and level. Install with bottom of base flush with concrete. Brace and secure steel post base devices in place prior to pouring concrete pier cap. Attach posts to bases in accordance with manufacturer's recommendations. Use all fasteners specified by manufacturer.

E. Anchor carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, strips, backing, and blocking of thickness and shape required to secure work and equipment in place, as indicated on the Drawings or required by conditions. Fasten wood grounds, furring and other engaging woodwork to various types of walls with approved types and sizes of nails, ties, and inserts, spaced to provide rigid secure supports.

3.02 ROUGH CARPENTRY: Provide wood grounds, strips, bucks, plates, backing, and blocking of thickness and shape required to secure work and equipment in place, as indicated on Drawings or required by conditions. Fasten with approve types and sizes of nails, ties, and inserts, spaced to provide rigid secure supports.

3.03 ROUGH HARDWARE: Provide rough hardware necessary or as required for installation of work specified. Use sufficient size and number of nails, screws, bolts, etc., to insure rigidity, security, and permanence.

3.04PLYWOOD ROOF SHEATHING: Install with long dimension perpendicular to supporting members. Nail 6" o.c. at panel ends and 12" o.c. at intermediate supports with 8d common nails. Install "H" clips between framing on all unsupported edges of plywoodroof sheathing. Panel spacing at ends and edges shall be 1/8".

Immediately upon completion and acceptance of the plywood roof sheathing installation –install the waterproof membrane/roofing underlayment as specified in Section 07600 in order to protect the roof deck from the environment.

3.05PLYWOOD WALL SHEATHING: Install with long dimension parallel to wood studs. Nail 6" o.c. at panel edges and 12" o.c. at intermediate studs with 8d common nails. Panel spacing at edges shall be 1/8". At the shear walls, refer to structural drawings for nailing and holdowns.

Immediately upon completion and acceptance of the plywood wall sheathing

installation – install the building wrap as specified in Section 07274 in order to protect the wall sheathing from the environment.

3.06CLEAN-UP: Remove from the premises all rubbish, debris, and unused materials which may be accumulated during the progress of the work.

END OF SECTION

SECTION 06120 - STRUCTURAL INSULATED PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Structural Insulated Panels (SIPs).

B. Related Sections: Section(s) related to this section include:

1. Section 06100 Rough Carpentry

2. Section 06090 Wood and Plastics Fastenings

1.02 SYSTEM DESCRIPTION

A. Structural Insulated Panels (SIPs) consist of oriented strand board (OSB) laminated with structural adhesives to a termite resistant EPS insulation core, a EPA registered treatment for mold, mildew, and termites, and SIP Manufacturer supplied connecting splines, sealants, and SIP screws.

1.03 REFERENCES

A. ACSE 7 - Minimum Loads for Buildings and other Structures.

B. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

C. DOC PS2 – Performance Standard for Wood-based Structural-Use Panels.

D. ICC ES AC04 – Acceptance Criteria for Sandwich Panels.

E. ICC ES AC05 – Acceptance Criteria for Sandwich Panel Adhesives.

F. ICC ES AC12 – Acceptance Criteria for Foam Plastic Insulation.

G. ICC ES AC239 – Acceptance Criteria for Termite-Resistant Foam Plastics.

H. AWPA E1 - Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.

I. AWPA E12- Standard Method of Determining Corrosion of Metal in Contact with Treated Wood.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

K. EPA - Registered products listing.

1.04 DESIGN REQUIREMENTS

A. Provide SIPs which have been manufactured, fabricated and installed to withstand loads in 2012 International Building Code and to maintain performance criteria stated by SIP manufacturer without defects, damage or failure.

1.05 SUBMITTALS

A. Product Data: Submit product data for specified products.

1. SIP Code Compliance: Provide ICC ES code report for SIP with evidence of compliance with code requirements as an alternate method of construction. Submit current compliance report number from ICC ES showing conformance to the 2012 International Building Code (IBC) and International Residential Code (IRC). Code report shall include compliance with ICC ES AC04 (Sandwich Panels) dated February 2012.

2. EPS Code Compliance: Provide ICC ES code report for EPS foam with evidence of compliance with code. Submit current compliance report numbers from ICC ES with conformance to the 2012 International Building Code (IBC) and International Residential Code (IRC). Code report shall include compliance with ICC ES AC12 (Foam Plastic) dated February 2011 and ICC ES AC239 (Termite-Resistance) dated October 2008.

3. Manufacturer’s Instructions: SIP Manufacturer’s Construction Manual and load design charts.

B. Calculations: Provide structural calculations by a registered architect or professional engineer in the state of qualified to perform such work.

C. Shop Drawings: Submit shop drawings for SIPs showing layout, elevations, product components and accessories.

D. Quality Assurance Submittals: Submit the following:

1. Certificate: Product certificate showing compliance to Third Party Quality Control program of PFS Corp.

E. Fire Resistant Assemblies: PFS construction number for each fire-rated assembly

F. Warranty: Warranty documents specified herein.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

B. Source Limitations: Obtain all SIPs through one source. All accessories to be as furnished or recommended by the SIP manufacturer.

1.07 Regulatory Requirements:

A. SIPs shall be recognized for compliance with International Building Code, International Residential Code, or specify in a current ICC ES evaluation report.

B. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, foundation/structural system/substrate conditions, SIP manufacturer installation instructions and SIP manufacturer warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

1.08 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with SIP manufacturer ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials from SIP manufacturer with identification labels or markings intact.

C. Off-load SIPs from truck and handle using fork lift or other means to prevent damage to SIPs.

D. SIPs shall be fully supported in storage and prevented from contact with the ground. Stack SIPs on pallets or a minimum of three stickers for every 8 feet of SIP length.

E. SIPs shall be fully protected from weather. Protect against exposure to rain, water, dirt, mud, and other residue that may affect SIP performance. Cover stored SIPs with breathable protective wraps. SIPs shall be stored in a protected area.

1.09 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit SIP manufacturer's standard warranty document. SIP Manufacturer warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Warranty Period: 20 years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 Manufacturers/Suppliers:

A. NoArk Enterprises, Inc., 10101 Highway 70 East, North Little Rock, AR 72117

B. AFM Corporation, 17645 Juniper Path, Suite 260, Lakeville, MN 55044

2.02 Materials

A. SIPs consisting of the following:

1. UL certified EPS core with Perform Guard treatment, minimum of 0.95 pcf (15.2 kg/m3) complying with ASTM C578 Type I and having ICC ES recognition of termite resistance. Insulation manufacturer shall provide Third Party UL certificate. ICC ES report shall be provided for recognition of termite resistance in compliance with ICC AC239.

2. OSB identified with APA or TECO performance mark with Exposure I durability rating and performance in accordance with DOC PS-2 span rating 24/16 or greater.

3. Adhesives shall be in conformance with ICC ES AC05 – Acceptance Criteria for Sandwich Panel Adhesives

4. FrameGuard treatment for mold, mildew, and termite resistance meeting the following requirements:

a. Registered with EPA.

b. Mold growth: 0 rating, tested to ASTM D3273 for 8 weeks at 77 degrees F and 100 percent relative humidity.

c. Termite resistance: Minimum rating of 7.0, tested to AWPA E-1.

d. Corrosion potential for metals in contact with treated wood: Maximum 2 mils per year, tested to AWPA E12 for minimum of

60 days on aluminum 2024, carbon steel, hot-dip galvanized steel, and G90 galvanized steel.

e. Equivalent lateral resistance and tooth holding capacity as untreated wood.

2.03 Accessories

A. Splines: OSB, block splines, or I-beam for use in joining SIPs shall be supplied by SIPs manufacturer.

B. Fasteners: corrosion resistant SIP screws compatible with SIP system shall be provided by the SIPs manufacturer.

1. Wood Screws for attachment to wood members

2. Heavy Duty Metal Screws for attachment to metal members (16 gauge to 3/16”)

3. Light Duty Metal Screws for attachment to metal decks (18 gauge or thinner)

C. SIP Sealant: Shall be specifically designed for use with SIPs. Sealant must be compatible with all components of the SIP. Sealant shall be provided by the SIP manufacturer. VOC content of SIP sealant shall be less than 10 g/L.

D. Dimensional Lumber: SPF, #2 or better, or engineered equivalent unless otherwise required by structural drawings.

E. Vapor Barrier SIP Tape: woven and coated polyolefin membrane with synthetic adhesive suitable for indoor use, min. 4 inch wide for use on SIP joints as specified by designer. SIP Tape shall be supplied by the SIP manufacturer.

2.04 Fabrication

A. Sizes: SIPs shall be fabricated in accordance with approved Shop Drawings

B. Thermal Resistance, R-value: 6 ½” thick SIP is selected.

1. 4 1/2” (114 mm) thick SIP with R-value of 15 at 75oF (16 at 40oF)

2. 6 1/2” (165 mm) thick SIP with R-value of 23 at 75oF (24 at 40oF)

3. 8 1/4” (210 mm) thick SIP with R-value of 29 at 75oF (32 at 40oF)

4. 10 1/4“ (260 mm) thick SIP with R-value of 37 at 75oF (40 at 40oF)

5. 12 1/4” (311 mm) thick SIP with R-value of 45 at 75oF (48 at 40oF)

C. Fire Performance Rating: Refer to Architectural Drawings.

2.05 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted without fourteen day (14) prior approval.

2.06 RELATED MATERIALS

A. Related Materials: Refer to other sections for related materials as follows:

1. Dimensional Lumber: SPF #2 or better or pre-engineered equivalent: Refer to Division 6 Carpentry Sections.

2.07 SOURCE QUALITY

A. Source Quality Assurance: Each SIP component required shall be supplied by SIP manufacturer and shall be obtained from selected SIP manufacturer or its approved supplier.

1. Each SIP shall be labeled indicating PFS Third Party certification.

2. Provide evidence of UL Third Party inspection and labeling of all insulation used in manufacture of SIPs.

3. SIP manufacturer shall provide Lamination, R-Value and mold/mildew/termite resistance warranty documents for building owner acceptance. Manufacturer standard forms will be submitted.

4. Provide SIPs with Foam-Control EPS with Perform Guard for termite resistance. Treatment shall be EPA registered with treatment efficacy substantiated by ICC ES report.

5. Provide SIPs with FrameGuard treatment for mold, mildew, and termite resistance. Treatment shall be EPA registered with treatment efficacy substantiated by independent research.

6. Dimensional Tolerance - shall comply with values listed in the manufacturer’s Quality Control Manual.

B. Source Quality: Obtain SIPs from a single manufacturer.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's ICC ES report, Load Design Charts, Construction Manual, Shop Drawings, and product data, including product technical bulletins, for installation.

B. Plans shall be reviewed by a qualified architect/engineer and shall be signed and/or sealed. Deviations from standard detail and load design values shall be calculated and signed and/or sealed by a qualified architect/engineer.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

1. Verify conditions of foundation/structural system/substrate and other conditions which affect installation of SIPs. Any adverse conditions shall be reported in writing. Do not proceed with installation until adverse conditions are corrected.

3.03 INSTALLATION

A. SIP Installation:

Complete installation recommendations are available from the manufacturer. SIP weight and contractor preference will dictate the erection method used. The use of a crane or lift truck may be required for SIP placement. Consult with SIP manufacturer for recommended handling methods. Supplementary lifting clamps and attachments to be provided by the contractor.

1. SIP Supports: Provide level and square foundation/structural system/substrate that support wall and/or roof SIPs. For wall SIPs, hold sill plate back from edge of rim board 7/16" (11 mm) to allow full bearing of OSB skins. Provide 1 1/2" (38 mm) diameter access holes in plating to align with electrical wire chases in SIPs. Provide adequate bracing of SIPs during erection. Remove debris from plate area prior to SIP placement.

2. SIP Fastening: Connect SIPs by nails as shown on drawings. SIP sealant must be used together with each fastening techniques. Where SIP Screw Fasteners are used, provide a minimum of 1" (25.4 mm) penetration into support. Join SIPs using plates and splines. Secure attachment with nails,

staples, or screws, and SIP sealant. Apply SIP sealant following SIP manufacturer recommendations.

3. SIP Tape: Provide SIP Tape at joints between SIP panels and at intersection of SIP roof and wall.

4. Vapor Retarders: Provide vapor retarders mandated by building code or climate conditions.

5. Thermal Barriers: Interior surfaces of SIPs shall be finished with a minimum 15-minute thermal barrier, such as 1/2" (13 mm) gypsum wallboard, nominal 1" (25 mm) wood paneling, or other approved materials. Apply code approved thermal barriers according to SIP manufacturer's recommendations.

6. Restrictions: Do not install SIPs directly on concrete. Do not put plumbing in SIPs without consulting SIP manufacturer. Do not overcut skins for field-cut openings and do not cut skins for electrical chases. SIPs shall be protected from exposure to solvents and their vapors that damage the EPS foam core.

7. Remove and replace insulated wall or roof SIPs which have become excessively wet or damaged before proceeding with installation of additional SIPs or other work.

3.04 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: 2 minimum.

3.05 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

1. Roof SIPs: Protect roof SIPs from weather. Provide temporary protection at the end of the day or when rain or snow is imminent.

2. After installation, cover SIPs to prevent contact with water on each exposed SIP edges and faces.

END OF SECTION

SECTION 06160 - PRE-MANUFACTURED WOOD TRUSS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included

Manufacture and install all pre-manufactured wood trusses as indicated on the Drawings and as specified herein. Also, see Design Drawings for additional design requirements.

B. Related Work Described Elsewhere

Carpentry Section 06110

Structural Insulated Panels Section 06 12 00

1.2 QUALITY ASSURANCE

A. Standards

Comply with the following standards (latest edition or locally adopted edition):

1. "National Design Specifications for Stress-Grade Lumber and its fastenings" by National Forest Products Associations.

2. "Timber Construction Standards" by American Institute of Timber Construction.

3. "Design Specifications for Light Metal Plate Connected Wood Trusses" by Truss Plate Institute.

4. American Lumber Standards PS-20-70 (U.S. Department of Commerce.)

5. International Building Code (Adopted Edition 2012).

B. Lumber Standard and Grade Marking

Each piece of lumber and each board shall comply with the American Lumber Standards and with specific grading requirements of the Association recognized as covering the species used and under who's grading rules it is produced. Each

piece of framing lumber and each board shall be identified by the grade mark of a recognized association or independent inspection agency.

C. Truss Connectors

All truss connectors shall be manufactured from ASTM A446-72 Grade A prime commercial quality galvanized sheet steel of no less than 20-gauge thickness which has a minimum yield of 33,000 psi and minimum ultimate tensile strength of 45,000 psi. The corrosion resistant coating shall be ASTM A525, "Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, General Requirements", Coating Designation G90 or ASTM A591, "Standards Specifications for Electrolytic Zinc Coated Steel Sheets". Coating Class C, or such treatment as will give equivalent corrosion protection. This protective coating may be applied to the sheet steel before the connector plates are stamped out; it is not necessary to recoat the connectors after the stamping operation. The connectors shall have a series of nail-like projections which are designed to separate the fibers of the wood into which they are pressed, in accordance with accepted nailing practices. Connectors may vary depending on component manufacturer approved.

D. Moisture Content of various materials shall meet the following requirements at time of installation:

Framing lumber 2 inches and less in thickness	Not more than 19 percent
Boards 8 inches or less in width	Not more than 19 percent
Wider than 8 inches	Not more than 15 percent

Finish lumber, millwork and trim not more than 12 percent.

E. Qualification of Manufacturers

All pre-manufactured wood trusses shall be fabricated in a properly equipped manufacturing facility of a permanent nature. They shall be manufactured by experienced workmen, using precision cutting and truss fabrication equipment, under the direct supervision of a qualified foreman. All trusses shall be fabricated under strict rules of inspection and quality control, open to the inspection of the Architect.

F. Pre-manufactured Wood Truss Design

Pre-manufactured Wood Truss Manufacturer shall be responsible for the design of all structural components and connections furnished with the pre-manufactured wood trusses. The design of the pre-manufactured wood trusses shall be designed in accordance with the preceding paragraphs and as indicated on the Drawings. Trusses shall be designed for appropriate Seismic zone, wind, and snow loads. Wood truss manufacturer shall submit shop drawings and design calculations stamped and signed by an Engineer licensed to practice in the State of Arkansas to be reviewed by Engineer of record. Shop drawings must show all dimensions for all trusses as well as roof plan showing truss locations. See Design Drawings for additional design requirements. (Including but not` limited to horizontal forces setting on particular trusses). The top chords shall be 3" minimum thick for SIP connections.

1.3 SUBMITTALS

A. General

Comply with the pertinent provisions of Section 01300.

B. Product Data

Submit the following to the Architect for review:

1. Shop Drawings: All pre-fabricated wood truss Shop Drawings shall bear the name and seal of the Design Engineer. Drawings shall include truss sizes and locations; design loading of truss and allowable stress increase; axial forces in each truss member; nominal sizes and location of connector plates at all joints; size, species and stress of grade of lumber for all truss members; camber; permanent lateral bracing as required by design to reduce buckling length of individual truss members; handling and erection recommendations.

1.4 PRODUCT HANDLING

A. Delivery and Storage

Pre-manufactured Wood Trusses shall be handled and stored so that they are not subject to damage. If the trusses are to be stockpiled prior to erection, sufficient beaming points and/or bracing shall be provided to prevent excessive lateral bending or tipping over.

B. Replacement

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GRADE AND SPECIES

A. Structural Lumber

Stressed members in bending, unless otherwise noted on the drawings, shall be 1300 psi "Fb" and 1,600 psi "E" stress-grade lumber, of the following species and of not lower than the grade shown:

Southern Yellow Pine #2 K.D.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Field verify all dimensions prior to fabrication of work under this Section

3.2 DESIGN

A. Trusses shall be designed to meet the design requirement set forth on the Roof and Roof Framing Plans on the Drawings. Computations shall be based on the new sizes of American Lumber Standards for dressed lumber corresponding to the given nominal size which are the minimum permissible. Each piece shall be selected for the minimum permissible. Each piece shall be selected for suitability and cut to avoid large or unsound knots at connections.

B. Joint connections and interior bracing for roof trusses shall be as required for an approved engineering designed truss system.

3.3 WORKMANSHIP

A. Carefully select all members. Select individual pieces so that knots and obvious defects will not interfere with attachment.

B. All members shall be accurately cut to length, angle and be true to line and dimensions, within a tolerance of 1/4" for length and 1/8" for height.

C. Trusses shall be erected in position, perpendicular to the wall plates. Trusses shall be straightened by nailing temporary spacers to top and bottom chords before application of roof sheathing.

D. All members and connector plates shall be properly placed in special jigs and the members tightly clamped in place, remaining in that position until the connector plates have been pressed into the lumber simultaneously on both sides of the joints.

E. Camber shall be built into the trusses, as noted on the engineering truss design, by properly positioning the members into the fabricating jig.

END OF SECTION

SECTION 06220 - MILLWORK

PART 1 - GENERAL

1.01 SCOPE: Furnish materials and labor necessary to fabricate items of millwork as indicated in Drawings and specified. The Quality Standards of the Architectural Woodwork Industry are hereby made part of this Section.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Rough Carpentry: Section 06100

B. Painting: Section 09900

1.03 SUBMITTALS: In accordance with Section 01300, Submittals.

A. Samples:

1. Submit samples of plastic laminate and two 6" x 6" samples of each type of veneer plywood specified for transparent finish for approval.

B. Shop Drawings:

1. Show sizes, quantities, markings, finishes and installed hardware.

2. Submit assembly and installation drawings to show methods of fastening, bracing and connecting to work of other trades.

PART 2 - PRODUCTS

2.01 QUALITY GRADE AND MATERIALS:

A. Millwork:

1. Quality grade and species called for herein under Interior Woodwork. Quality grade as defined in AWI Quality Standards, Section 400.

2. Framing Lumber, Blocking, Bracing: No 2 southern pine, S4S, kiln dried. Floor plates shall be pressure treated.

3. Painted Plywood: Shall be paint grade birch. Thickness and locations as indicated on Drawings.

4. Stained Plywood: Shall be Plain Sliced White Birch. Thickness and locations as indicated on the Drawings.

5. Laminated Plastic: As manufactured by the Nevamar Corporation, or approved equal. Color and finish as selected by the Owner. Plastic laminate back-up shall be fir plywood.

6. Where noted painted interior wood trim shall be clear, S4S, Kiln Dried White Birch.

7. Where noted stained interior White Birch trim shall be clear, S4S, Kiln Dried Plain Sliced White Birch.

B. Cabinet Hardware:

Each Door:
1 Pull Stanley #4483½ (US 26D)
1 Pair Hinges Stanley #331 Hinge

Each Drawer:
1 Pull Stanley #4483½ (US 26D)
1 Set Drawer Slides KV 1300

Adjustable Shelves
Provide each shelf with KV255 standards and KV256 supports as noted.
Option: Shelving 32mm. Line Bore Adjustable Shelving

Locks
For cabinet doors (Where indicated) Sargent 1654 (US 26D) with strike.

Magnetic Catches For cabinet doors (single) SP46, (double) SP45

C. Shelving: As noted on Drawings.

PART 3 - EXECUTION

3.01 JOB ASSEMBLED WORK: When installing items not shop assembled, distribute to best overall advantages defects allowed in quality-grade specified.

3.02 DELIVERY AND STORAGE: Do not deliver millwork until building and/or storage area is sufficiently dry so woodwork will not be damaged by excessive changes in moisture content.

3.03 WORKMANSHIP:

A. Fabricate items of millwork to conform to "Custom" material and workmanship requirements as established by Architectural Woodwork Institute in the publication "Quality Standards of Architectural Woodwork Industry".

B. Verify all dimensions in the field prior to fabrication.

C. Accurately set all cabinets plumb, square, level and permanently secured in position as indicated.

D. Coordinate the work with other trades affected by installation, including electrical and telephone work. Provide other cut-outs as required for equipment. All cut-outs shall be finished same as finish on material cut-outs.

E. Provide all necessary rough wood framing, blocking, bracing, angle clips, rough hardware and fastenings as required to secure anchorage of carpentry work. Support wall hung cabinets and shelving on gypsum board walls with 2 x 4 fire treated wood blocking within the wall cavity.

F. Pay particular attention to the timely installation of wood grounds, nailers and blocking so as not to delay job progress.

3.04 CLEANING: Remove all soil, stains, paint, prints and other matter from exposed faces and hardware. Clean adjacent surfaces of soiling incurred during installation.

END OF SECTION

SECTION 07110 - SHEET MEMBRANE VAPOR BARRIERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SCOPE

A. Provide membrane vapor barriers complete, as called for on the Drawings.

1.3 SUBMITTALS

A. Comply with Section 01300.

B. Product Data: Submit product data and general recommendations from water-proofing materials manufacturer for types of materials required.

C. Samples: Submit samples of sheet waterproofing and auxiliary materials as requested by Architect.

D. Certificates: Include certificates substantiating that materials comply with specified requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer: Obtain primary materials from a single manufacturer, too greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: Firm with not less than three years of successful experience in installations similar to requirements of this project and which is acceptable to manufacturer of primary waterproofing system manufacturers.

1.5 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

1.6 WARRANTY

A. Submit written warranty, executed by manufacturers, agreeing to repair and replace sheet membrane waterproofing system that fails in materials and workmanship.

B. Warranty period is five (5) years.

PART 2 – PRODUCTS

2.1 VAPOR BARRIERS

A. Provide 15 mil vapor barrier as called out on the Drawings at all areas under concrete floor slabs.

B. Provide Self-Adhering SBS-Modified Bitumen Flashing Tape such as 'Fortiflash' or equal as shown on the Drawings at steel columns and beams

2.2 ROOF UNDERLAYMENT

A. Provide a single layer of Self-Adhered SBS-Modified Bitumen Underlayment at all sloped roofs with Standing Seam Roofing Panels such as 'Grace Ice and Water Shield HT' or equal.

2.3 THROUGH WALL FLASHING

A. Thru-wall flashing shall be 30 mil thick elastomeric flashing sheet membrane equal to Nervastral Seal-Pruf HD, or approved equal. Install 30 mil elastomeric Nervastral wall Flashing at locations indicated on the Drawings, including but not limited to, window heads, base of masonry cavity walls, masonry parapets and other openings in exterior masonry walls as required to provide watertight protection.

PART 3 – EXECUTION

3.1 PREPARATION

A. Comply with manufacturer's instructions for surface preparation.

B. Chip off projections where necessary for proper placement and adhesion of waterproofing sheet.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of sheet waterproofing materials.

C. Seal projections through membrane and seal seams.

3.3 PROTECTION

A. Provide for protection of completed membrane during installation of other materials or processes over membrane and throughout remainder of construction period.

END OF SECTION

SECTION 07150 – MASONRY WATER REPELLANT

PART 1 - GENERAL

1.01 SCOPE: Furnish all labor, materials, and equipment necessary to complete the application of the Masonry Water Repellant.

1.02 RELATED WORK SPECIFIED IN OTHER SECTION:

A. Pre-Blended Mortar: Section 04110

PART 2 - PRODUCTS

2.01 SAMPLES: Submit complete samples of each coating specified with manufacturer's specifications attached.

2.02 GUARANTEES: Upon completion and acceptance of the work, provide the following written warranties to the Owner prior to final payment.

A. Masonry Water Repellant Installer's Warranty: Provide Installer’s written two (2) year guarantee against defects, water penetration, effloresence, discoloring, etc.

2.03 MATERIALS:

A. Masonry Water Repellant: Equal to Hydrozo Environmental Plus, V.O.C. Compliant with 10 year warranty, penetrating silane by Hydrozo, Lincoln, Nebraska.

PART 3 - EXECUTION

3.01 INSTALLATION OF MASONRY WATER REPELLANT:

A. Brick Masonry Veneer shall be treated with a siloxane type penetrating water repellant material. The water repellant shall not alter the natural appearance of the masonry. Surfaces to be treated may be "damp" but should be visually dry and thoroughly clean and free of surface dirt, dust, oils and other contaminants. Water repellant shall be applied in strict accordance with manufacturers printed instructions.

3.02 FIELD QUALITY CONTROL:

A. Site Tests, Inspection: Masonry Water Repellant Rilem II, 4 Test.

B. Manufacturer’s Field Services: Provide manufacturer's representative to perform a Rilem II, 4 Test.

3.03 CLEANING:

A. Remove all trash and debris from the site. Keep areas clean or excess materials and rubbish during and after application. Keep pavements broom clean and work area in orderly condition.

B. Remove all spatters, spillage and soiling with appropriate cleaning agents and procedures from adjacent and surrounding equipment, surfaces and substrates and leave area in neat and clean condition.

3.04 PROTECTION: Protect finished installation until Final Acceptance.

END OF SECTION

SECTION 07214
SPRAY FOAM INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closed Cell Spray Foam Insulation.

1.2 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C 1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

H. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

I. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

J. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

K. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.

B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).

C. Handling: Handle materials to avoid damage.

1.7 PRE-APPLICATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.8 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.

C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.

D. To avoid overspray, product should not be applied when conditions are windy.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

Acceptable Manufacturer: CertainTeed Corp., Insulation Group, which is located at: 750 E. Swedesford Rd. P. O. Box 860; Valley Forge, PA 19482-0860; Toll Free Tel: 800-233-8990; Fax: 610-341-7940

A. Substitutions: Permitted.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SPRAY FOAM INSULATION

A. Insulation: HFC-blown type Closed Cell Foam: CertainTeed CertaSpray Closed Cell Foam is a medium-density, MDI-based polyurethane thermoset rigid foam. When CertaSpray A-side closed cell is mixed with CertaSpray B-side closed cell under pressure in a 1:1 volumetric ratio, they react and expand into a medium-density closed cell foam with an in-place core density of 1.9- 2.2 pcf:
   1. Physical and Mechanical Properties:
      a. Core Density: 1.9-2.4 pcf when tested in accordance with ASTM D 1622.
      b. Thermal Resistance (aged): 5.8 less than or equal to 2-1/2 inches / 6.4 when greater than 2-1/2 inches when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft2- degrees F)/Btu.
      c. Thermal Resistance (initial): 6.4 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft2- degrees F)/Btu.
      d. Closed Cell Content: 88-95 percent when tested in accordance with ASTM D 2842.
      e. Compressive Strength: Greater than 25 psi when tested in accordance with ASTM D 1621.
      f. Tensile Strength: 23 psi when tested in accordance with ASTM D 1623.
      g. Water Absorption: Less than 2 percent by volume when tested in accordance with ASTM D 2842.
      h. Dimensional Stability: Less than 9 percent by volume when tested in accordance with ASTM D 2126 at 75 degrees F/95 percent RH, 28 Day.
      i. Water Vapor Transmission: 1.3 perm/inch when tested in accordance with ASTM E 96.
      j. Air Permeability: 0.013 when tested in accordance with ASTM E 283 at 1 inch thickness, L/s/m2.
      k. Fungi Resistance: Pass, with no growth when tested in accordance with ASTM C 1338.
   2. Fire performance
      a. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.
      b. Smoke: Less than 450 when tested in accordance with ASTM E 84.
   3. Thermal Performance (aged): Tested in accordance with ASTM C 518 and/or ASTM C 177 at 75 degrees F (24 degrees C) mean temperature.
      a. Thickness 1 inch (25 mm), R-Value 5.8 (h-ft2-degreesF)/Btu (1.0 (m2-degreesC)/W).
      b. Thickness 1-12 inches (38 mm), R-Value 8.7 (h-ft2-degreesF)/Btu (1.5 (m2-degreesC)/W).

c. Thickness 2 inches (51 mm), R-Value 11.6 (h-ft2-degreesF)/Btu (2.0 (m2-degreesC)/W).
d. Thickness 2-12 inches (64 mm), R-Value 16.0 (h-ft2-degreesF)/Btu (2.8 (m2-degreesC)/W).
e. Thickness 3 inches (76 mm), R-Value 19.2 (h-ft2-degreesF)/Btu (3.4 (m2-degreesC)/W).
f. Thickness 3-12 inches (89 mm), R-Value 22.4 (h-ft2-degreesF)/Btu (3.9 (m2-degreesC)/W).
g. Thickness 4 inches (102 mm), R-Value 25.6 (h-ft2-degreesF)/Btu (4.5 (m2-degreesC)/W).
h. Thickness 4-12 inches (114 mm), R-Value 28.8 (h-ft2-degreesF)/Btu (5.1 (m2-degreesC)/W).
i. Thickness 5 inches (127 mm), R-Value 32.0 (h-ft2-degreesF)/Btu (5.6 (m2-degreesC)/W).
j. Thickness 5-12 inches (140 mm), R-Value 35.2 (h-ft2-degreesF)/Btu (6.2 (m2-degreesC)/W).
k. Thickness 6 inches (152 mm), R-Value 38.4 (h-ft2-degreesF)/Btu (6.8 (m2-degreesC)/W).

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that all exterior wall assembly construction has been completed to the point where the insulation may correctly be installed.

C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.

D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Mask and protect adjacent surfaces from overspray or dusting.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.

B. Apply insulation by spray method, to uniform monolithic density without voids.

C. Apply to minimum cured thickness as indicated on the Drawings or as scheduled at the end of this Section.

D. Apply to minimum cured thickness of 2 inches.

E. Apply to achieve thermal resistance R-Value of 11.6.

F. Seal plumbing stacks, electrical wiring and other wall penetrations to control air leakage.

G. Apply insulation to fill voids.

H. Apply insulation to fill voids around windows. Apply insulation to fill voids around accessible service and equipment penetrations.

I. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.

J. Patch damaged areas.

3.4 FIELD QUALITY CONTROL

A. Inspection will include verification of insulation and density.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SCHEDULES

A. For the following locations, apply the average cured thickness indicated.
1. exterior wood frame walls: 2 inches.

END OF SECTION

SECTION 07274 - COMMERCIAL BUILDING WRAP

PART 1 - GENERAL

1.01 SUMMARY

A. Includes but not limited to:
   1. Furnish and install air barrier/weather resistant barrier over exterior of wall sheathing at all locations regardless of whether or not indicated on drawings to protect exterior sheathing and interior walls.

1.02 RELATED SECTIONS

A. Section 06160 – Pre-Manufactured Wood Truss
B. Section 07600 – Flashing and Sheet Metal

1.03 REFERENCES:

A. American Society for Testing and Materials
B. Technical Association of Pulp and Paper Industry
C. American Association of Textile Chemists and Colorists

1.04 SUBMITTALS:

A. General: Submit each item in this Article according to the conditions of the Contract and Division I Specifications Sections.
B. Product Data: Submit product specifications, technical data and installation instructions of manufacturer equaling or exceeding those specified.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Installer with successful experience in the installation of air barrier/secondary weather resistant barriers.
B. Install job mock-up using specified air barrier/secondary weather resistant barrier with system of fastening and taping seams as per manufacturer's instructions. Obtain architect's approval of system for appearance and workmanship standard.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

DuPont Weatherization Systems	Contact
4417 Lancaster Pike	800-448-9835
Building 728	
Wilmington, DE 19805	www.tyvek.com

2.02 MATERIALS

A. DuPont™ Tyvek® CommercialWrap®: A flash spunbonded olefin, non-woven, non-perforated secondary weather resistant barrier.

B. Performance Characteristics:
   1. AATCC-127, Water Penetration Resistance, exceeded at 280.
   2. TAPPI T-460, Gurley Hill (sec/100cc) Air infiltration at >1500 seconds.
   3. ASTM E 96 Method B(g/m2-24hr.)Water vapor transmission of 200.
   4. TAPPI T-41D, Basis weight of 2.7 oz/yd.
   5. ASTM E96 Method B, Water Vapor Transmission, 28 perms.
   6. ASTM E1677, Air Retarder Material Standard Specification, Type I air barrier.

C. Sealing Tape/Fasteners
   1. DuPont™ Tyvek® Tape, DuPont Weatherization Systems.
   2. For steel frame construction: DuPont™ Tyvek® Wrap Cap Screws, DuPont Weatherization Systems. 1 5/8" rust resistant screws with 2" diameter plastic cap.
   3. For wood frame construction: DuPont™ Tyvek® Wrap Caps, DuPont Weatherization Systems. Nails with large heads or plastic washers.
   4. Caulks or Sealanta: polyurethane or elastomeric sealants
      a. Available Products:
         1. OSI® Quad Pro-Series®, solvent release butyl rubber sealant.
         2. DAP® Dynaflex 230™.
         3. Other products as approved and recommended by air barrier/weather resistant barrier manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Air Barrier over exterior side of exterior wall sheathing.
   1. Install Air Barrier after sheathing is installed and before windows and doors are installed. Install lower level barrier prior to upper layers to ensure proper shingling of layers.
   2. Overlap Air Barrier at corners of building by a minimum of 12 inches.
   3. Overlap Air Barrier vertical seams by a minimum of 6 inches.
   4. Ensure barrier is plum and level with foundation, and unroll extending Air Barrier over window and door openings.
   5. Attach Air Barrier to wood, insulated sheathing board or exterior gypsum with plastic cap nails every 12" to 18" on vertical stud line with wood stud framing, and screws with washers to metal stud framing. When attaching to masonry, use adhesive recommended by manufacturer.
   6. Prepare window and door rough openings as follows:

a. Prepare each window rough openings by cutting a modified "I" pattern in the Air Barrier.
   1. Horizontally cut Air Barrier along bottom of header.
   2. Vertically cut Air Barrier down the center of window openings from the top of the window opening down to 2/3 of the way to the bottom of the window openings.
   3. Diagonally cut Air Barrier from the bottom of the vertical cut to the left and right corners of opening.
   4. Fold side and bottom flaps into window opening and fasten every 6 inches. Trim off excess.

b. Prepare each rough door opening by cutting a standard "I" pattern in the Air Barrier.
   1. Horizontally cut Air Barrier along bottom of door frame header and along top of sill.
   2. Vertically cut Air Barrier down the center of the door openings from the top of the door opening (header) down to the bottom of the door opening (sill).
   3. Fold side flaps inside around door openings and fasten every 6 inches. Trim off excess.

7. Tape all horizontal and vertical seam of Air Barrier with DuPont™ Tyvek® Tape.
8. Seal all tears and cuts in Air Barrier with DuPont™ Tyvek® Tape.

END OF SECTION

SECTION 07410
PREFORMED METAL STANDING SEAM ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers the pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 SUMMARY

A. Section Includes
    1. Factory formed Standing Seam metal roof panels and all components necessary for a complete and watertight assembly.
B. Related work specified elsewhere:
    1. Section 07600 - Flashing and Sheet Metal
    2. Section 06120 - SIP's Panels
    3. Section 07900 – Joint Sealants

1.3 DEFINITIONS

A. Metal Roof Panel Systems: Metal roof panels, attachment system components, miscellaneous framing, vapor barriers, underlayment, flashing, trim, and accessories necessary for a complete weathertight roofing system.
B. References:
    1. American Society for Testing and Materials (ASTM)
        a. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Process
    2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
        a. SMACNA Architectural Sheet Metal Manual, 1993 edition
    3. Code References
        a. International Building Code, 2006 Edition.

1.4 QUALITY ASSURANCE

A. Petersen Aluminum Corp, Tyler, TX, 800-441-8661 products establish a minimum of quality required.
B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.
C. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.5 SUBSTITUTIONS

A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution.

1.6 SYSTEM DESCRIPTION

A. Material to comply with:
    1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

1.7 ROOF SYSTEM PERFORMANCE TESTING

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.
C. Panels to meet:
    1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
    2. Roof System shall be designed to meet a UL Class 90 wind uplift in accordance with UL standard 580 and panel system shall be ASTM 1592 Tested and approved
    3. UL 2218 - Impact Resistance rated.

1.8 WARRANTIES

A. Weathertight warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
    1. Warranty Period: 20 Years from date of Substantial Completion
B. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
    1. Exposed Panels Finish - deterioration includes the following:
        a. Color fading more than 5 hunter units when tested according to ASTM D 2244
        b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214
        c. Cracking, checking, peeling or failure of a paint to adhere to a bare metal.
    2. Warranty Period: 20 Years from the date of substantial completion

C. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

1.9 SUBMITTALS

A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
B. Provide finish samples of all colors specified.
C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels or metal soffit panels, details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
D. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved:
    1. Roof panels and attachments
    2. Steel Framing, bracings and supports
    3. Roof-mounted items.

1.10 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.
B. Deliver components, sheets, metal roof panels and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.
D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting or other surface damage.
E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.11 PROJECT CONDITIONS

A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed.
B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.12 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.
B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoining work to provide a leakproof, secure and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PANEL DESIGN

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.
B. Roof panels shall be Snap Clad standing seam in 16" widths with 1 3/4" high seam.
C. Panels to be produced without Factory supplied hot melt mastic in the seams.
D. Panels to be produced Smooth - Factory Standard.
E. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.
F. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.2 ACCEPTABLE MANUFACTURERS

A. This project is detailed around the roofing product of Petersen Aluminum Corporation Petersen Aluminum Corp, Tyler, TX, 800-441-8661, TITE-LOC.

2.3 MATERIALS AND FINISHES

A. Preformed roofing panels shall be fabricated of 24 GA Steel
B. Color shall be selected by the Architect from Manufacturer’s standard colors
C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.
H. Substrate shall be ½" OSB over 2x6 T&G wood decking.
I. Roofing Underlayment
    1. On all surfaces to be covered with roofing material, furnish and install a 40 mil "Peel & Stick membrane", required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
        a. W.R Grace "Ice & water Shield"
        b. Cetco Strongseal
        c. Carlisle CCW WIP 300HT
        d. Interwrap Titanium PSU
        e. MFM Corp "Wind & Water Shield"
        f. Polyguard Deck Guard HT of Polyglas HT
        g. Tamko TW Tile and Metal Underlayment
    2. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6", and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
J. Sealants
    1. Exterior grade silicone sealant recommended by roofing manufacturer or

2.4 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
B. Fabricate components of the system in factory, ready for field assembly.
C. Fabricate components and assemble units to comply with fire performance requirements specified.
D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

A. Secure units to supports
B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION

SECTION 07412 – EXPOSED FASTENER

FACTORY MANUFACTURED PREFORMED WALL PANELS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers the pre-finished, pre-fabricated exposed fastener metal wall system panels. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 SUMMARY

A. Section Includes
  1. Factory formed exposed fastener metal wall panels
B. Related work specified elsewhere.
  1. Section 06100 – Carpentry
  2. Section 07274 - Commercial Building Wrap
  3. Section 07214 – Spray Foam Insulation
  4. Section 07600 - Flashing and Sheet Metal
  5. Section 07900 - Joint Sealants

1.3 DEFINITIONS

A. Metal Wall Panel Assembly**:** Wall panels, attachment system components, wood framing, miscellaneous framing, plywood sheathing, building wrap, foam insulation, trim, flashing, and accessories necessary for a complete weathertight wall system.
B. References:
  1. American Society for Testing and Materials (ASTM)
    a. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate
  2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
    a. SMACNA Architectural Sheet Metal Manual, 1993 edition
  4. Aluminum Association
    a. Aluminum Design Manual
  5. Metal Construction Association
    a. Preformed metal Wall Guidelines
  6. Code References
    a. ASCE, Minimum Loads for Buildings and Other Structures
    b. IBC International Building Code

1.4 QUALITY ASSURANCE

A. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.
B. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.5 WALL SYSTEM PERFORMANCE TESTING

A. General Performance: Metal Wall panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
B. Panels to meet:
   1. Wall System shall be designed to meet applicable Local Building Code and the System shall have been tested by the Manufacturer and have the applicable Load Tables published from this testing for loads.

1.6 SUBMITTALS

A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
B. Provide finish samples.
C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels or metal soffit panels, details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
D. Coordination Drawings: Building elevations drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved:
   1. Wall panels, trims and attachments.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer’s ordering instruction and lead time requirements to avoid construction delays.
B. Deliver components, sheets, metal wall panels and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
C. Unload, store and erect metal roof/wall panels in a manner to prevent bending, warping, twisting and surface damage.
D. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof/wall panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting or other surface damage.

E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed.
B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate metal panels with rain drainage work, flashing, trim and other adjoining work to provide a leakproof, secure and noncorrosive installation.

PART 2 – PRODUCTS

2.1 PANEL DESIGN

A. General: Provide factory-formed, prefinished, lappable exposed fastener, structural wall panel system, that has been pretested and certified by manufacturer to comply with specified requirements under installed conditions.
B. Wall panels shall be exposed fastener:
   - § PAC-CLAD PETERSEN 7.2 PANEL OR EQUAL
   - §
C. Structural Requirements: Engineer panels for structural properties in accordance with latest edition of American Iron and Steel Institute's Cold Formed Steel Design Manual using effective width concept and Aluminum Associations Aluminum Design Manual.
D. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.
E. Panels shall be directly fastened to the substrate.
F. The panel shall have an overlapping sidelap feature.

2.2 MATERIALS AND FINISHES

A. Preformed wall panels shall be fabricated of
Gauge - 24 GA, grade 40 (40 KSI yield strength) structural steel
ASTM A366 CRCQ.
FINISH: Paint Kynar 500/Hylar 5000 (color to be selected by Architect)

B. Texture: Panel shall be smooth.

C. If Strippable coating is to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.

D. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting. Trim to be fabricated in accordance with standard SMACNA procedure and details.

E. Closures: shall be pre-molded polyethylene to match the profile of the exposed fastener panel and shall be in lengths as supplied by the panel manufacturer.

F. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity

1. Fasteners shall have combination steel and EPDM washers
2. Screws for panel to girt/purlins shall be sufficient to penetrate the supporting member by 1”. All fasteners shall be applied in accordance with the fastening schedule as provided by panel manufacturer.
3. Screws for flashings and sidelaps shall be #14 HHA x ¾” sheet metal stitch screws. All accessories, flashings and sidelaps shall be fastened 12” OC.

G. Substrate shall be

- Plywood

H. Caulking: All caulking and sealing shall be done in a neat manner with excess caulking or sealant removed from exposed surfaces.

I. Caulking shall be non-skinning, non hardening gun grade butyl sealant or butyl sealant tape with a minimum thickness of 1/4" where it is concealed and where thermal movement must be accommodated. All caulking or sealing shall be done in a neat manner with excess caulking or sealant removed from exposed surfaces.

J. Vapor Retarder: retarder with a permeance of 0.05 or less as determined by ASTM 98.

2.3 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer’s standard product fabrication.

B. Fabricate components of the system in factory, ready for field assembly.
C. Fabricate components and assemble units to comply with fire performance requirements specified.
D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.
E. Panels are lappable. It is recommended that individual steel wall panels not exceed 16' in length for thermal movement reasons.
F. Panels shall be roll formed on a stationary industrial type rolling mill to gradually shape the sheet metal. Portable rollformers rented or owned by the installer, are not acceptable.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine alignment of supports, primary and secondary roof framing, and solid roof sheathing, prior to installation. Components should comply with shop drawings and be smooth, even, sound and free of depressions.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

A. Secure units to supports
B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation. Conform to standards set forth in SMACNA architectural sheet metal manuals and approved shop drawings for this project.
C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.
D. Install panel system so it is watertight, without waves, warps, buckles or distortions, and allow for thermal movement considerations.
E. Abrasive devices shall not be used to cut on or near roof or wall panel system.
F. Apply sealant tape or caulking as necessary at flashing and panel joints to prevent water penetration.
G. Remove any strippable film immediately upon exposure to direct sunlight.

H. Vapor retarder: The joints, perimeter, and all openings shall be sealed per the manufacturer's instructions to provide a continuous vapor retarder.

I. Underlayment (solid substrate):

1. Provide one layer of 30# felt with horizontal overlaps and endlaps staggered between layers.

3.4 DAMAGED MATERIAL

A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION

SECTION 07450

SINGLE-PLY THERMOPLASTIC MEMBRANE ROOFING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duro-Last PVC thermoplastic membrane adhered with water-based adhesive.

B. Prefabricated flashings, corners, parapets, stacks, vents, and related details.

C. Fasteners, adhesives, and other accessories required for a complete roofing installation.

D. Traffic Protection.

1.2 REFERENCES

A. NRCA - The NRCA Roofing and Waterproofing Manual.

B. ASCE 7 - Minimum Design Loads For Buildings And Other Structures.

C. UL - Roofing Materials and Systems Directory, Roofing Systems (TGFU.R10128).

D. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

E. ASTM D 751 - Standard Test Methods for Coated Fabrics.

F. ASTM D 4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.

G. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

H. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SYSTEM DESCRIPTION

A. General: Provide Duro-Last PVC Thermoplastic Membrane and Accessories or equal. Other acceptable Manufacturers include but are not limited to:

1. Sika Sarnafil-Sikaplan Adhered System
2. Carlisle -Sure Flex Fully Adhered PVC Roofing System
3. Johns Manville Fully Adhered PVC Roofing System
4. GAF Everguard Fully Adhered PVC Roofing System

Submit alternate systems for consideration per Section 01630. Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Physical Properties:

1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D 4434 and must meet or exceed the following physical properties.
2. Thickness: 50 mil, nominal, in accordance with ASTM D 751. Color - White.
3. Thickness Over Scrim: ≥ 28 mil in accordance with ASTM D 751.
4. Breaking Strengths: ≥ 390 lbf. (MD) and ≥ 438 lbf. (XMD) in accordance with ASTM D 751, Grab Method.
5. Elongation at Break: ≥ 31% (MD) and ≥ 31% (XMD) in accordance with ASTM D 751, Grab Method.
6. Heat Aging in accordance with ASTM D 3045: 176 °F for 56 days. No sign of cracking, chipping or crazing. (In accordance with ASTM D 4434).
7. Factory Seam Strength: ≥ 417 lbf. in accordance with ASTM D 751, Grab Method.
8. Tearing Strength: ≥ 132 lbf. (MD) and ≥ 163 lbf. (XMD) in accordance with ASTM D 751, Procedure B.
9. Low Temperature Bend (Flexibility): Pass at -40 °F in accordance with ASTM D 2136.
10. Accelerated Weathering: No cracking, checking, crazing, erosion or chalking after 5,000 hours in accordance with ASTM G 154.
11. Linear Dimensional Change: < 0.5% in accordance with ASTM D 1204 at 176 ± 2 °F for 6 hours.
12. Water Absorption: < 1.7% in accordance with ASTM D 570 at 158 °F for 166 hours.
13. Static Puncture Resistance: ≥ 56 lbs. in accordance with ASTM D 5602.
14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D 5635.

D. Cool Roof Rating Council (CRRC):

1. Membrane must be listed on CRRC website.
   a. Initial Solar Reflectance: ≥ 88%
   b. Initial Thermal Emittance: ≥ 87%
   c. Initial Solar Reflective Index (SRI): ≥ 111
   d. 3-Year Aged Solar Reflectance: ≥ 68%
   e. 3-Year Aged Thermal Emittance: ≥ 84%
   f. 3-Year Aged Solar Reflective Index (SRI): ≥82

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Duro-Last data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Maintenance requirements.

C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.

D. Verification Samples: For each product specified, two samples, representing actual product, color, and finish.

1. 4 inch by 6 inch sample of roofing membrane, of color specified.

2. 4 inch by 6 inch sample of walkway pad.

3. Termination bar, fascia bar with cover, drip edge and gravel stop if to be used.

4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.

E. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

F. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with manufacturer's installation instructions.

B. Manufacturer Qualifications: A manufacturer specializing in the production of PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.

C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.

D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.

E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for roof assembly wind uplift and fire hazard requirements.

B. Fire Exposure: Provide membrane roofing materials with the following fire-test-response characteristics. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure:

a. Class A; ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: Comply with ASTM E 119 for fire-resistance-rated roof assemblies of which roofing system is a part.
3. Conform to applicable code for roof assembly fire hazard requirements.

C. Wind Uplift:

1. Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of the ASCE-7 Specification *Minimum Design Loads for Buildings And Other Structures*.

1.7 PRE-INSTALLATION MEETING

A. Convene meeting not less than one week before starting work of this section.

B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following.

1. Meet with Architect, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the warranty issued by the manufacturer.

B. Manufacturer's Warranty: Must provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition the warranty must meet the following criteria:

1. Warranty Period: 20 years from date issued by the manufacturer.
2. Coverage to maximum wind speed of 90 mph.
3. No exclusion for damage caused by ponding water.
4. No exclusion for damage caused by biological growth.
5. Issued direct from and serviced by the roof membrane manufacturer.
6. Transferable for the full term of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: Duro-Last Roofing, Inc., which is located at: 525 Morley Drive, Saginaw, MI 48601. Telephone: 800-248-0280.

B. All roofing system components to be provided or approved by Duro-Last Roofing, Inc.

C. Substitutions: Submit substitution requests per Section 01630.

2.2 ROOFING SYSTEM COMPONENTS

A. Roofing Membrane: Duro-Last® PVC thermoplastic membrane conforming to ASTM D 4434, type III, fabric-reinforced, PVC. Membrane properties as follows:

1. Thickness:
   a. 50 mil
2. Exposed Face Color:
   a. White.

B. Accessory Materials: Provide accessory materials supplied by or approved for use by Duro-Last Roofing, Inc.

1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
2. Duro-Last Factory Prefabricated Flashings: manufactured using Manufacturer's standard reinforced PVC membrane.
   a. Stack Flashings.
   b. Curb Flashings.
   c. Inside and Outside Corners.

3. Sealants and Adhesives: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
    a. Duro-Caulk® Plus.
    b. Strip Mastic.
4. Slip Sheet: Compatible with roofing system and supplied by Duro-Last Roofing, Inc.
5. Fasteners and Plates: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by Duro-Last Roofing, Inc.
6. Termination and Edge Details: Supplied by Duro-Last Roofing, Inc.
    a. Termination Bar.
7. Vinyl Coated Metal: Supplied by Duro-Last Roofing, Inc. 24 gauge, hot-dipped galvanized, grade 90 metal with a minimum of 17 mil of Duro-Last membrane laminated to one side.

C. Walkways:
1. Provide non-skid, maintenance-free walkway pads in areas of heavy foot traffic and around mechanical equipment.
    a. Duro-Last Roof Trak III Walkway Pad.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the surfaces and site conditions are ready to receive work.
B. Verify that the deck is supported and secured.
C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
D. Verify that the deck surfaces are dry and free of standing water, ice or snow.
E. Verify that all roof openings or penetrations through the roof are solidly set.
F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.

3.3 INSTALLATION

A. Install insulation in accordance with the roof manufacturer's requirements.

B. Install ‘Georgia Pacific’ ¼” DensDeck Roof Cover Board over SIP’s panels per Manufacturer's requirements.

C. Roof Membrane: 50 mil, Duro-Last PVC thermoplastic membrane.

1. Use only membrane adhesive acceptable to the roof manufacturer’s that meets the applicable design requirements.

a. Water-based membrane adhesive.

2. Cut membrane to fit neatly around all penetrations and roof projections.

3. Unroll roofing membrane and positioned with a minimum 6 inch overlap.

4. Apply adhesive in accordance with the roof manufacturer’s requirements.

a. Apply at the required rate in smooth, even coatings without voids, globs, puddles or similar irregularities. Use care not to contaminate the area of the membrane where hot air welding will occur.

5. Follow guidelines outlined in the adhesive’s Product Data Sheet.

6. Read the adhesive’s Material Safety Data Sheet (MSDS) prior to using the adhesive.

D. Seaming:

1. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.

2. Check field welded seams for continuity and integrity and repair all imperfections by the end of each work day.

E. Membrane Termination/Securement: All membrane terminations shall be completed in accordance with the membrane manufacturer’s requirements.

1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.

2. Provide securement at any angle change where the slope or combined slopes exceeds two inches in one horizontal foot.

F. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer’s requirements.

1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.

a. Do not apply flashing over existing thru-wall flashings or weep holes.

b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.

c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.

d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).

2. Penetrations:
    a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
    b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.
    c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
3. Pipe Clusters and Unusual Shapes:
    a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.
    b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
    c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.

G. Roof Drains:
1. Coordinate installation of roof drains and vents specified in Section 15146 - Plumbing Specialties.
2. Remove existing flashing and asphalt at existing drains in preparation for sealant and membrane.
3. Provide a smooth clean surface on the mating surface between the clamping ring and the drain base.

H. Edge Details:
1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.
2. Join individual sections in accordance with the membrane manufacturer's requirements.
3. Coordinate installation of metal flashing and counter flashing specified in Section 07620.
4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies specified in Section 07710.

I. Walkways:
1. Install walkways in accordance with the membrane manufacturer's requirements.
2. Provide walkways where indicated on the Drawings.
3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.

J. Water cut-offs:

1. Provide water cut-offs on a daily basis at the completion of work and at the onset of inclement weather.
2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
3. Remove water cut-offs prior to the resumption of work.
4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed and final punch list completed and submitted to the Architect.

3.5 PROTECTION

A. Protect installed roofing products from construction operations until completion of project.

B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.

C. Repair or replace damaged products after work is completed.

END OF SECTION

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SCOPE: Provide all sheet metal work, complete, including flashing and counterflashing.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Joint Sealants: Section 07900
B. Standing Seam Metal Roofing: Section 07410
C. Single Ply Thermoplastic Membrane Roofing: Section 07450

1.03 SHOP DRAWINGS: Prior to fabrication, submit shop drawings for each typical sheet metal item indicating materials, gages, jointing, and fastening.

1.04 JOB CONDITIONS: Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Sheet Metal:

1. Aluminum Sheets: ASTM B 209, alloy 3003, temper #14, mill finish, .032" thick.

2. Pre-painted Steel Sheets: 24 gage hot dipped galvanized steel (G90) commercial quality, primed and finished one side with Kynar base fluoropolymer coating 1.0 mil total dry film thickness, and with wash coat on reverse side. Coat pre-painted side with liquid applied factory installed strippable film for protection of finished surface.

3. Color to be selected by Architect from Manufacturer’s standard color chart.

B. Nails, Screws, and Rivets: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with materials being fastened.

C. Roof Cement: ASTM D 2822, asphaltic.

D. Mastic Sealant: Polyisobutylene; non-hardening, nonskinning, non-drying, non-migrating sealant.

E. Bitumastic Coating: Cold applied solvent type bitumastic coating for application in dry film thickness of 15 mils per coat.

F. Metal Accessories: Sheet metal clips, cleats, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

G. Sealants: As specified in Section 07900.

H. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by manufacturer for non-moving joints including riveted joints.

I. Paper Slip Sheet: 5-lb. rosin-sized building paper.

J. Polyethylene Underlayment: 6 mil carbonated polyethylene film.

2.02 FABRICATION:

A. Fabricate counterflashing, flashing, and other sheet metal work not exposed to view of aluminum. Fabricate through wall scuppers and other sheet metal work exposed to view of pre-painted steel sheets.

B. Fabricate work to comply with "SMACNA" Architectural Sheet Metal Manual", metal manufacturer's recommendations, and recognized industry practices.

C. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates.

D. Form exposed sheet metal work without excessive oil- canning, buckling and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

E. Fabricate pre-painted steel with strippable film in place. If soldering is necessary, mechanically remove coating. Touch up with color matched paint.

F. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

G. Expansion Provisions: Where lapped or bayonet-type expansion provisions cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).

H. Separate dissimilar metals from each other by painting each metal surface in area of contact with a heavy application of bitumastic coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine substrates and conditions under which metal flashing and trim will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. SMACNA Details: Except as otherwise indicated or specified, comply with applicable recommendations and details of SMACNA "Architectural Sheet Metal Manual".

B. Manufacturer's Recommendations: Except as otherwise indicated or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.

C. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

D. Underlayment: Where aluminum is to be installed directly on cementitious or wood substrates, install a course of paper slip sheet and a course of polyethylene underlayment.

E. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

F. Retainers: Where indicated, provide saw cuts for securing edges of flashings to other work. Insert flashings in sheet metal retainers. Insert flashing and seal flashing in retainer with sealant. Provide wedges of lead or other compatible metal, spaced 2' o.c., and drive well into retainer so as to be completely covered by sealant.

G. Secure edges of flashing to other work with angles and bars, and seal with sealant as indicated.

H. Roofing Cement Edges: Where indicated, seal edges of metal flashings to substrates with roofing cement; install bed or bead of cement in manner which will maintain a watertight seal.

I. Remove strippable film from pre-painted steel work.

3.03 CLEAN-UP: After completion of work, clean roofing cement, sealant and bituminous paint from flashing, floors, and all surfaces so defaced. Remove all excess materials and scraps from the job and leave all surfaces neat and clean.

END OF SECTION

SECTION 07900 – JOINT SEALANTS

PART 1 - GENERAL

1.01 SCOPE: Completely close with caulking compound or sealant all joints. Include joints around frames of doors, windows, or other openings in exterior walls, flooring joints, joints at wall intersections, joints at penetrations of walls, decks, and floors by piping and other services and equipment, joints between items of equipment and other construction, and other joints indicated or specified to be caulked or sealed.

1.02 QUALITY ASSURANCE: Obtain elastomeric materials only from manufacturer who will, if requested, send a qualified technical representative to project site, for purpose of advising Installer of proper procedures and precautions for use of materials.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications, recommendations, and installation instructions for each type of sealant, caulking compound and miscellaneous materials. Include letter of certification, or certified test laboratory reports indicating that each material complies with requirements and is intended for applications indicated.

B. Samples: Submit 12" long sample of each color required (except black) for each type of sealant or caulking compound exposed to view. Install sample between 2 strips of material similar to or representative of typical surfaces where sealant or caulking compound will be used, held apart to represent typical joint widths. Samples will be viewed for color only.

1.04 JOB CONDITIONS:

A. Examine joint surfaces, backing, and anchorage of units forming sealant rabbet. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Do not proceed with installations of sealants under adverse weather conditions, or when temperatures are above or below manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

2.02 ELASTOMERIC JOINT SEALANTS: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for type, Grade Class, and Uses.

A. Two-Component Nonsag Polysulfide Sealant: Type M, Grade NS, Class 12-1/2. Sonneborn "Sonolastic", Pecora "Synthacalk GC-5 Series", Dap "Flexiseal 700 Series", or Woodmont "Chem-Calk 200".

B. Two-Or-More Component Nonsag Urethane Sealant: Type M, Grade NS, Class 25. Tremco "Dymeric", Sonneborn "Sonolastic NP II", Woodmont "Chem-Calk 500", or Pecora "Dynatrol".

C. Two-Component Pourable Urethane Sealant: Type M, Grade P, Class 25. Tremco "THC 900", Woodmont "Chem-Calk 550", or Pecora "NR-200".

D. One-Component Mildew-Resistant Silicone Sealant: Type S, Grade NS, Class 25. GE "SCS 1702", Dow Corning "786", Tremco "Proglaze White", or Pecora "863 #345".

2.03 ACRYLIC CAULKING: One component, nonsag, acrylic, paintable, mildew-resistant, complying the ASTM C 834. Tremco "AcryLatex Caulk", Sonneborn "Sonolac", Pecora Corp. "AC-20", or Woodmont "Chem-Calk 600".

2.04 NEOPRENE SEAL: Provide vertical elastomeric compression seal material as manufactured by Waston Bowman Acme Corp., Armherst, New York 14120.

2.05 MISCELLANEOUS MATERIALS:

A. Joint Cleaner: Type of joint cleaning compound recommended by sealant or caulking compound manufacturer for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Type recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

D. Sealant Backer Rod: Compressible rod stock open cell polyurethane foam. Provide size and shape of rod which will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint in compressed.

PART 3 - EXECUTION

3.01 JOINT TYPES AND USAGES: Caulking and sealant usage is specified below.

A. Caulking: All interior joints except joints with metal and aluminum.

B. Sealants: Use polysulfide or polyurethane at all exterior joints and all interior joints with aluminum and metal. Use mildew resistant silicone sealant at sinks and plumbing fixtures. Use minimum 35 Shore A hardness polyurethane sealant for horizontal joints subject to foot traffic.

3.02 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture, and other substances which would interfere with bond of sealant or caulking compound.

B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating. Remove coating or treatment from joint surfaces before installing sealant.

C. Etch concrete and masonry joint surfaces to remove excess alkalinity. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

D. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.03 INSTALLATION:

A. Comply with sealant manufacturer's printed instructions, except where more stringent requirements are indicated or specified and except where manufacturer's technical representative directs otherwise.

B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

C. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Employ only proven standard installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.

For joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.

For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

G. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant/caulking compound.

H. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to the adjoining surfaces or finishes.

3.04 CURE AND PROTECTION: Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability. Cure and protect sealants in a manner which will minimize increases in modules of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

END OF SECTION

SECTION 08110 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SCOPE: Provide metal frames, hollow metal doors, and related items required to complete the work.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Hardware: Section 08710

B. Painting: Section 09900

1.03 QUALITY ASSURANCE:

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100), and as specified.

B. Provide metal doors and frames manufactured by a single firm.

1.04 SUBMITTALS:

A. Product Data: Submit copy of manufacturer's technical data and installation instructions.

B. Shop Drawings: Prior to fabrication of any work, submit shop drawings indicating gage of metals, details of construction, profile of moldings, connections to other work, fastenings and anchors.

1.05 TEMPLATES: Obtain templates from hardware supplier for proper location of hardware drillings and reinforcements.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Deliver, handle, and store metal doors and frames in a manner to prevent damage and deterioration.

B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings as required to completely protect all metal doors and frames during transportation and storage.

C. Store doors upright, in a protected dry area, at least 1" off ground and with at least 1/4" air space between individual pieces. Protect all primed and hardware surfaces as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Steelcraft, Republic Steel, Ceco or Dittco.

2.02 MATERIALS:

A. Steel Sheet:

1. Doors: 18 gage cold rolled, stretcher leveled; free of scale, pitting or other surface defects. Close tops and bottoms of exterior doors with inverted steel channels.

2. Frames: 16 gage hot rolled, pickled and oiled, or cold rolled as specified above.

B. Core: Continuously reinforced with a full core of resin-impregnated kraft fiber honeycomb with 1" nested, hexagonal-shaped cells, or solid slab of expanded polystyrene. Bond core to inside of both face sheets.

C. Primer: Manufacturer's standard rust inhibitive primer.

D. Anchors, Fasteners, Accessories: Manufacturer's standard, hot-dipped galvanized at exterior.

2.03 FABRICATION:

A. General Requirements:

1. Fabricate steel doors and frames rigid, neat in appearance and free from defects, warp, or buckle. Provide clean cut, straight and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce as required for hardware and at corners as required to prevent sagging. Accurately form metal to required sizes and profiles.

2. Fit, assemble and weld units at factory or shop.

B. Doors: Seamless construction (no visible seams on face or vertical edge), of sizes and designs as indicated.

C. Frames: Combination stop and frame channel section, rabbeted for doors, of type and styles indicated.

1. Anchors/Fasteners: Supply the proper fastenings and/or anchors to secure frames in each type of structural framing indicated.

2. Silencers/Mutes: Drill stops to receive a minimum of 3 silencers on strike jamb.

2.04 HARDWARE:

A. Preparation: Prepare hollow metal units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling and tapping, in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.

B. Location of Hardware: Locate finish hardware as indicated in final shop drawings and/or in compliance with Door and Hardware Institute publication "Recommended Location for Builder's Hardware".

2.05 GLAZING STOPS (BEADS), METAL FRAMED GLASS: Provide manufacturer's standard steel channel or tubular stops, predrilled for screws and factory finished as specified for doors and frames. Glass and glazing is specified in Section 08800.

2.06 FINISH: Dress tool marks and surface imperfections to smooth surfaces and remove irregularities. Chemically treat and clean doors and frames. Apply manufacturer's standard baked-on rust inhibitive primer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install hollow metal units and accessories in compliance with final shop drawings, manufacturer's instructions, and as specified below.

B. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.

C. Clearances: Provide clearances of not more than 1/8" at jambs and heads and not more than 3/4" from floor or 3/16" from thresholds.

D. Hardware: Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.

3.02 PRIME COAT TOUCH-UP: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up with compatible air-drying primer.

END OF SECTION

SECTION 08110.1 - TORNADO-RESISTANT DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division1 Specification Sections, apply to this Section.

1.2 SCOPE

A. Provide metal frames, hollow metal doors, and related items required to complete the Project. Doors and frames requiring labeled construction are indicated on Door Types and on Door Schedule.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Hardware; Section 08710.
B. Painting; Section 09900.

1.4 SUBMITTALS

A. Comply with Section 01300.
B. Product Data: Submit copy of manufacturer's technical data and installation instructions.
C. Shop Drawings: Prior to fabrication of work, submit shop drawings indicating gage of metals, details of construction, profile of moldings, connections to other work, fastenings and anchors.

1.5 QUALITY ASSURANCE

A. Provide doors and frames that are **UL certified to FEMA 361, 320 and ICC500**.
B. Provide metal doors and frames manufactured by a single firm.
C. Provide units tested, listed and labeled in accordance with FEMA 361, 320, and ICC500, do not paint labels.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store metal doors and frames in a manner to prevent damage and deterioration.
B. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings as required to completely protect metal doors and frames during transportation and storage.
C. Store doors upright, in a protected dry area, at least 1" off ground and with at least 1/4" air space between individual pieces. Protect primed and hardware surfaces as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

CECO Tornado-Resistant Doors and Frames (The StormPro System) is specified as basis of design. Equivalent products are acceptable. Any substitutions must be submitted as per Section 01300 and within 60 days of the start of construction as indicated by the date of the Notice to Proceed. The Architect shall be the judge of the equivalency and acceptability of any substitutions.

2.2 MATERIALS

A. Steel Sheet:
   1. Doors: 16 gage cold rolled, stretcher leveled; free of scale, pitting or other surface defects.
   2. Frames: 14 gage hot rolled, pickled and oiled, or cold rolled as specified above.

B. Door Core: Polystyrene Honeycomb cells. Bond core to inside of both face sheets.

C. Primer: Manufacturer's standard rust inhibitive primer; do not paint testing agency labels.

D. Anchors, Fasteners, Accessories: Manufacturer's standard, hot-dipped galvanized at exterior. **Refer to Drawings for Frame Anchoring Details.**

E. Channel Fillers: Flush steel channel fillers for top channel of exterior doors.

2.3 FABRICATION

A. General:
   1. Fabricate steel doors and frames rigid, neat in appearance and free from defects, warp, or buckle. Provide clean cut, straight and true molded members, well formed and aligned miters, dressed and ground smooth, and where applicable, concealed fasteners. Reinforce at corners as required to prevent sagging. Accurately form metal to required sizes and profiles, including astragals.
   2. Fit, assemble, and weld units at factory or shop.

B. Frames: Combination stop and frame channel section, rabbeted for doors, of type and styles indicated.
   1. Anchors/Fasteners: Supply the proper fastenings and/or anchors to secure frames in each type of structural framing indicated to comply with **FEMA 361, 320 and ICC500. Anchor Frames per Drawings.**
   2. Silencers/Mutes: Drill stops to receive a minimum of 3 silencers on strike jamb on single swing frames and 2 on heads of double swing frames.
   3. All frames to be mitered welded and ground smooth at corners.

2.4 HARDWARE

A. Preparation: Prepare metal units to receive mortised and concealed finished hardware, including cutouts, reinforcing, drilling and tapping, in accordance with final Finish Hardware Schedule and templates provided by the hardware supplier. Reinforce metal units to receive surface-applied hardware. Drilling and tapping for surface-applied hardware will be done on the job site.

B. Location of Hardware: Locate finish hardware as indicated in final Shop Drawings and/or in compliance with Door and Hardware Institute publication "Recommended Location for Builder's Hardware".

2.5 FINISH

A. Dress tool marks and surface imperfections to smooth surfaces and remove irregularities. Chemically treat and clean doors and frames. Apply manufacturer's standard baked-on rust inhibitive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal units and accessories in compliance with final shop drawings, manufacturer's instructions, and as specified below.

B. Set frames accurately in position, plumb and aligned, and securely anchor to adjacent construction.

C. Erect fire doors and frames in compliance with NFPA 80.

D. Clearances: Provide clearances of not more than 1/8" at jambs and heads and not more than 3/4" from floor or 3/16" from thresholds.

E. Hardware: Install hardware, adjust as required to provide smooth and proper operation with secure latching or locking.

F. Rust Prevention: Prior to installation, coat back of all exterior H.M.,- restroom & janitors door frames, 1’-0 above finish floor with bituminous paint. Coordinate painting of the tops and bottoms of all doors prior to setting door.

3.2 PRIME COAT TOUCH-UP

A. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up with compatible air-drying primer.

END OF SECTION

SECTION 08210 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SCOPE: Provide solid core wood doors with wood veneer faces, complete.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Hollow Metal Door and Frames: Section 08110

B. Hardware: Section 08710

C. Painting: Section 09900.

1.03 SUBMITTALS:

A. Product Data: Submit door manufacturer's product data including details of core and edge construction.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, details of construction, location and extent of hardware blocking, and other pertinent data.

C. Warranty: Submit warranty as required in Paragraph 1.06.

D. Submit samples of finishes.

1.04 QUALITY ASSURANCE: Provide doors complying with the following standards:

A. ANSI/NWWDA I.S.1: "Industry Standard for Wood Flush Doors", published by National Woodwork Manufacturers Association" (NWMA).

B. AWI Quality Standards: Section 1300 "Architectural Flush Doors" of "Architectural Woodwork Quality Standards" published by Architectural Woodwork Institute (AWI). Designations for grade and door construction under types of doors refers to this standard.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced ANSI

standard and recommendations of NWMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", and with manufacturer's instructions.

B. Identify each door with numbers which correlate with designation system used on shop drawings for door and hardware, using temporary, removable or concealed markings.

1.06 WARRANTY: Provide written agreement on door manufacturer's standard form signed by manufacturer, installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards. Warranty shall be five (5) years for solid core interior doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Weyerhauser, Algoma, Eggers, Fenestra, and Graham.

2.02 INTERIOR FLUSH WOOD DOORS: Refer to schedule for location.

A. Solid core doors for stained finish, complying with the following requirements:

1. Faces: Plain Sliced
2. Spec: White Birch
3. Grade: Custom
4. Matching: Center Book Matched
5. Construction (Minimum Requirements): PC-5 (particle board core, 5 ply), or SLC-5 (glued block core, 5 ply), at contractor's option.
6. Factory Finish: Submit Stain sample for approval by architect

2.03 FABRICATION: Fabricate flush wood doors to produce doors complying with the following requirements:

A. In sizes indicated for job-site fitting.

B. Provide exposed edges of same species as face veneer. Seal exposed edges with door manufacturer's recommended sealer. Belt-sand and hand-sand doors, ready for painter.

PART 3 - EXECUTION

3.01 INSPECTION: Examine doors and doorframes for the following purposes:

A. To verify that frames comply with indicated requirements for type, size, location, and swing and have been installed with plumb jambs and level heads.

B. To verify that doors are free of defects that could cause their rejection.

3.02 INSTALLATION: Install wood doors to comply with manufacturer's instructions, referenced NWMA Standards, and as specified.

A. Condition doors to average prevailing humidity in installation area prior to hanging.

B. Align and fit doors in frames with uniform clearances and bevels as specified below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
2. Bevel doors 1/8" in 2" at lock and hinge edges.

C. Hardware: For installation refer to Section 08700 of these specifications.

3.04 ADJUST AND CLEAN:

A. Rehang or replace doors which do not swing or operate freely.

B. Take protective measures to assure that wood doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08400 - ALUMINUM FRAMING

PART 1 - GENERAL

1.1 SCOPE

A. Provide the various types of aluminum framing systems complete.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Glass and glazing requirements; Section 08800.

1.3 SUBMITTALS

A. Comply with Section 01300.

B. Shop Drawings: Submit shop drawings for the fabrication and installation of framing and associated components. Include wall elevations at 1/2 scale, and half size detail sections of every typical composite member. Show anchors, joint system, expansion provisions, glazing and sealing details, finishes.

C. Warranty: Submit executed warranty.

D. Samples: Submit sample of finish and glass specified for Architect's verification.

1.4 WARRANTY

A. Submit a warranty signed by the manufacturer, contractor, and installer, agreeing to replace glazing which fail in materials and workmanship within 2 years of the date of acceptance. Failure of materials or workmanship shall include, but not be limited to, excessive leakage of air infiltration, excessive deflections, delamination of panels, deterioration of finish or metal in excess of normal weathering, and defects in accessories, and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Kawneer is specified, equivalent systems of VistaWall, US Aluminum, and Efco are acceptable, equivalent systems of other manufacturers will be considered, submit for prebid approval in compliance with Section 01300.

2.2 FRAMING

System: (Exterior), Kawneer TriFab 451T, 2” X 4-1/2” framing members designed for **CENTER SET** glazing applications, with 1” insulated glass units. Glass as specified in Section 08800. Finish of Aluminum shall be clear anodized.

2.3 FINISH

A. Kawneer #14 Clear Anodized Aluminum, Aluminum Association Specification, AA-M12C22A41, Architectural Class 1. Anodic finishes shall meet the requirements of the Aluminum Association DAF-45 and AAMA 611 for anodized architectural aluminum.

2.4 OTHER MATERIALS

A. Provide all other materials, not specifically described but required for a complete, weathertight, and proper installation of framing systems, subject to acceptance by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in compliance with manufacturer's specifications, recommendations and final shop drawings.

B. Set units plumb, level and true to line, without warp or rack of framing. Anchor securely in place. Secure to structure with non-staining, non-corrosive shims, anchors, fasteners, spacers, and fillers. Use care in erection so as not to mar, abrade, or stain finished surfaces.

1. Seal frames with an approved sealant in color to match frames, making a neat fully weatherproof job. Refer to Section 07900, and comply with requirements of that section.

C. Paint concealed contact surfaces of dissimilar materials, including metal in contact with masonry or concrete work, with heavy coating of bituminous paint, or provide other separation as recommended by manufacturer.

3.2 CLEANING

A. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.

B. Clean glass surfaces after installation. Remove excess glazing and sealant compounds, dirt, and other substances.

3.3 PROTECTION

A. Institute protective measures required throughout remainder of construction period to ensure that units will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION

SECTION 08410 - ALUMINUM ENTRANCE DOORS

PART 1 - GENERAL

1.01 SCOPE: Furnish materials and labor necessary to furnish and install aluminum entrance doors as indicated in the Drawings and specified.

1.02 RELATED WORK IN OTHER SECTIONS:

A. Aluminum Framing: Section 08400

B. Hardware: Section 08710

C. Glass and Glazing: Section 08800

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS: Submit shop drawings showing complete installation details and materials prior to fabrication.

2.02 MATERIALS:

A. Aluminum Entrance Doors: Shall be Medium Style Door, as indicated in the drawings, and manufactured by Kawneer, or approved equal. Including:

1. Flush Bolts

2. Panic Device: Von Duprin 1690 concealed rod panics (PNRS) or 99 Series RM Panic (single doors) with appropriate cylinder lock and key dogging 110 (NL) trim. See Note 11.

3. Provide 1" tubular push bar CP2 on interior vestibule to match tubular CO9 pull, where applicable. See Note 11.

4. Style C09 Pulls

5. Manufacturers standard set-off pivots

6. All doors to receive sealair weathering system with door bottom seal.

7. Lock Mechanism (MS Locks). See Note 11.

8. Closers to be LCN 4040 surface closer with delayed action and parallel arm. Maximum Force - 8.5 lbs/Exterior, 5 lbs/interior.

9. Cylinder by hardware supplier.

10. ADA approved metal threshold

11. Coordinate panics, locks and push bars with Door Schedule.

B. Finish: All exposed surfaces shall have clear anodized finish free of scratches and other serious blemishes.

PART 3 - EXECUTION

3.01 WORKMANSHIP:

A. Examine all elements over which doors are to be applied. Examine all adjoining work on which the work of this Section is in any way dependent.

B. Verify all governing dimensions.

C. Report any unsatisfactory conditions that would prevent the proper installation of the system or endanger its permanency. Starting work shall imply acceptance of the previously placed work for that area.

3.02 INSTALLATION:

A. Erect doors plumb, square and in proper operating condition.

B. Install doors in exact accordance with manufacturer's latest published details, instructions and specifications.

3.03 GUARANTEE: All doors shall be guaranteed against defects in materials or workmanship for a period of two (2) years from date of final completion of all work.

END OF SECTION

SECTION 08710 HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Include screws, special screws, bolts, special bolts, expansion shields, and other devices for proper application of hardware.
2. If an opening is omitted from the hardware groups, provide hardware of type and quality for similar door operation.
3. Includes furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors. Except items, which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.
4. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored

B. Related Sections:

1. 06100 – Rough Carpentry
2. 08110 –Hollow Metall Doors and Frames
3. 08210 – Flush Wood Doors
4. 08400 – Aluminum Framing
5. Division 16 – Electrical

C. Related Documents:

1. Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section.

1.02 REFERENCES

A. Standards

1. ANSI A156.1 – Butts and Hinges
2. ANSI A156.2 – Bored Locks and Latches
3. ANSI A156.3 – Exit Devices
4. ANSI A156.4 – Door Controls – Door Closers
5. ANSI A156.5 – Auxiliary Locks and Associated Products
6. ANSI A156.6 – Architectural Door Trim
7. ANSI A156.7 – Template Hinge Dimensions
8. ANSI A156.8 – Door Controls – Overhead Holders
9. ANSI A156.13 – Mortise Locks and Latches
10. ANSI A156.15 – Closer Holder Release Devices
11. ANSI A156.16 – Auxiliary Hardware
12. ANSI A156.18 – Material and Finishes
13. NFPA 80 – Fire Doors and Windows
14. UL10C – Positive Pressure Fire Tests of Door Assemblies

B. Codes

1. NFPA 101 – Life Safety Code
2. IBC 2003 – International Building Code
3. ANSI A117.1 – Accessible and Usable Buildings and Facilities
4. ADA – Americans with Disabilities Act

1.03 SUBMITTALS

A. General Requirements:

1. Submit copies of finish hardware schedule in accordance with Division 1, General Requirements.

B. Schedules and Product Data

1. Schedules to be in vertical format, listing each door opening, and organized into "hardware sets" indicating complete designations of every item required for each door opening to function as intended. Hardware schedule shall be submitted within two (2) weeks from date the purchase order is received by the finish hardware supplier. Furnish four (4) copies of revised schedules after approval for field and file use. Note any special mounting instructions or requirements with the hardware schedule. Schedules to include the following information:

(a) Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
(b) Handing and degree of swing of each door.
(c) Door and frame sizes and materials.
(d) Keying information.
(e) Type, style, function, size, and finish of each hardware item.
(f) Elevation drawings and operational descriptions for all electronic openings.
(g) Name and manufacturer of each hardware item.
(h) Fastenings and other pertinent information.
(i) Explanation of all abbreviations, symbols and codes contained in schedule
(j) Mounting locations for hardware when varies from standard.

2. Submit catalog cuts and/or product data sheets for all scheduled finish hardware.
3. Submit separate detailed keying schedule for approval indicating clearly how the owner's final instructions on keying of locks has been fulfilled.

C. Samples

1. Upon request, samples of each type of hardware in finish indicated shall be submitted. Samples are to remain undamaged and in working condition through submittal and review process. Items will be returned to the supplier or incorporated into the work within limitations of keying coordination requirements.

D. Templates

1. Furnish a complete list and suitable templates, together with finish hardware schedule to contractor, for distribution to necessary trades supplying materials to be prepared for finish hardware.

E. Electronic Hardware Systems

1. Provide complete wiring diagrams prepared by an authorized factory employee for each opening requiring electronic hardware, except openings where only magnetic hold-open devices are specified. Provide a copy with each hardware schedule submitted after approval.
2. Provide complete operational descriptions of electronic components listed by opening in the hardware submittals. Operational descriptions to detail how each electrical component functions within the opening incorporating all conditions of ingress and egress. Provide a copy with each hardware schedule submitted for approval.
3. Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Provide a copy with each hardware schedule submitted for approval.

4. Prior to installation of electronic hardware, arrange conference between supplier, installers and related trades to review materials, procedures and coordinating related work.
5. The electrical products contained within this specification represent a complete engineered system. If alternate electrical products are submitted, it is the responsibility of the distributor to bear the cost of providing a complete and working system including re-engineering of electrical diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with electrical engineer and electrician to ensure that line voltage and low voltage wiring is coordinated to provide a complete and working system.
6. For each item of electrified hardware specified, provide standardized molex plug connectors to accommodate up to twelve (12) wires. Molex plug connectors shall plug directly into through-door wiring harnesses, frame wiring harnesses, electric locking devices and power supplies.

F. Operations and Maintenance Manuals

1. Upon completion of construction and building turnover, furnish two (2) complete maintenance manuals to the owner. Manuals to include the following items:

(a) Approved hardware schedule, catalog cuts and keying schedule.
(b) Hardware installation and adjustment instructions.
(c) Manufacturer’s written warranty information.
(d) Wiring diagrams, elevation drawings and operational descriptions for all electronic openings.

1.04 QUALITY ASSURANCE

A. Substitutions

1. All substitution requests must be submitted before bidding and within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and his hardware consultant.

B. Supplier Qualifications

1. A recognized architectural door hardware supplier who has maintained an office and has been furnishing hardware in the project’s vicinity for a period of at least three (3) years.
2. Hardware supplier shall have office and warehouse facilities to accommodate this project.
3. Hardware supplier shall have in his employment at lease one (1) Architectural Hardware Consultant (AHC) who is available at reasonable times during business hours for consultation about the project’s hardware and requirements to the owner, architect and contractor.
4. Hardware supplier must be an authorized factory distributor of all products specified herein.
5. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

a. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
b. Review sequence of operation for each type of electrified door hardware.
c. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
d. Review required testing, inspecting, and certifying procedures.

C. Manufacturer Qualifications

1. Use only the manufacturer’s listed in Part 2 products.

2. Use only BHMA (Builders Hardware Manufacturer's Association) certified products unless the product specified is unavailable as certified.

D. Installer Qualifications

1. Firm with 3 years experience in installation of similar hardware to that required for this project, including specific requirements indicated.

E. Regulatory Label Requirements

1. Provide door hardware for fire-rated openings that comply with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed by Underwriter's Laboratories (UL) or Warnock Hersey (WH) for use on types and sizes of doors indicated.

2. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

a. Hardware required for fire doors shall be listed with Underwriters Laboratories for ratings specified.

b. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

F. Handicapped Requirements

1. Doors to stairs (other than exit stairs), loading platforms, boiler rooms, stages and doors serving other hazardous locations shall have knurled or other similar approved marking of door lever handles or cross bars in accordance with local building codes.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware to jobsite in manufacturer's original packaging, marked to correspond with approved hardware schedule. Do not deliver hardware until suitable locked storage space is available. Check hardware against reviewed hardware schedule and lay out on shelves by hardware group. Store hardware to protect against loss, theft, or damage.

B. Deliver hardware required to be installed during fabrication of hollow metal, aluminum, wood, or stainless steel doors prepaid to manufacturer.

1.06 WARRANTY

A. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.

1. Cylindrical locksets – Heavy Duty: Five (5) years
2. Mortise locksets: Five (5) years
3. Exit Devices: Five (5) years
4. Door closers: Ten (10) years

B. Replace shortages and incorrect items with correct material at no additional cost to Owner.

C. At completion of project, qualified factory representative shall inspect closer installations. After this inspection, letter shall be sent to Architect reporting on conditions, verifying that closers have been properly installed and adjusted.

1.07 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.1 BUTTS AND HINGES

A. Hinges shall be certified to comply to ANSI A156.1 and have the number of knuckles as specified, oil-impregnated bearings as specified with NRP (non-removable pin) feature, at all lockable reverse bevel doors.

B. Acceptable Manufacturers and Types:

Type	McKinney	Hager	Stanley
Type 1	T4A3795	BB1262	FBB268
Type 2	TA2714	BB1279	FBB179
Type 3	TA2314	BB1191	FBB191
Type 4	T4A3786	BB1168	FBB168
Type 5	T4A3386	BB1199	FBB199

C. Application:

1.	Exterior out-swinging doors	Type 5 x NRP
2.	Exterior inswinging doors and vestibule doors	Type 4
3.	Interior doors with closers	Type 2 or 4
4.	Interior doors over 36 inches wide	Type 4
5.	Interior doors 36 inches or less without closer	Type 2

D. Size:

1.	2-1/4 inch Doors	5 inch by 5 inch
2.	1-3/4 inch Doors	4-1/2 inch by 4-1/2 inch
3.	1-3/8 inch Doors	3-1/2 inch by 3-1/2 inch

E. Quantity:

1. 2 - hinges per leaf for openings through 60 inches high.
2. 1 - additional hinge per leaf for each additional 30 inches in height or fraction thereof.
3. 4 - Dutch doors up to 90 inches in height.

F. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood doors.

2.2 FLUSH BOLTS AND DUSTPROOF STRIKES

A. Acceptable manufacturers:

McKinney	Door Controls	Trimco
FB01M	780	3915
FB06M	842NH	3810
FB10W	942NH	3815
DPS1	80	3910

B. Non-labeled Openings: Provide 2 flush bolts FB01M for inactive leaf of pairs of locked and latched doors. Locate centerline of top bolt not more than 78 inches from finished floor. Provide dustproof strike FB06M for bottom bolt.

C. Labeled Openings: Provide automatic flush bolt set FB06M or FB10W, as applicable, for inactive leaf of pairs of doors. Provide dustproof strike DPS1 for bottom bolt.

2.3 LOCKSETS – MORTISE

A. Acceptable Manufacturer and Series:

Manufacturer	Series
Sargent	8200 x LNL
Yale	8800FL x AUR
Corbin/Russwin	ML2000 x NSA
Best	45H X 15

B. Provide lock functions specified in Hardware Groups, with following provisions:

1. Cylinders: Manufacturer's removable core 6-pin.
2. All locksets shall be ANSI 156.13 Series 1000, Grade 1 Certified. Operational Grade 1, and Security Grade 1.
3. Backsets: 2-3/4 inches.
4. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike and protected to allow practical and secure operation.

2.4 EXIT DEVICES

A. Acceptable Manufacturers:

Sargent	Yale	Corbin-Russwin
80 Series	7000 Series	ED5000 Series

B. Provide exit device series and functions as specified in Hardware Groups. Sargent product numbers are referenced in the Hardware Groups.

C. All exit devices shall be ANSI A156.3, Grade 1 Certified and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101.

D. All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be UL listed as "Fire Exit Hardware".

E. Where lever trim is specified, provide lever design to match lockset levers.

F. Provide cylinders for exit devices with locking trim and cylinder dogging.

G. Provide cylinder dogging feature for non-rated exit devices.

H. Provide keyed removable mullions, as specified in the Hardware Groups.

2.5 KEYING

A. Master key or Grand master key cylinders and key in groups, unless otherwise specified. Factory masterkey with manufacturer retaining permanent keying records.

B. Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Provide 2 control keys for core removal. Stamp keys "DO NOT DUPLICATE."

C. Submit proposed keying schedule to Architect. If requested, meet with Owner and Architect to review schedule.

D. Provide high security removable core cylinders, with patented key control, for each lock with construction masterkeying. Permanent cores shall be installed upon completion of the project.

E. Cylinders shall meet the requirements of UL437.

2.6 DOOR TRIM

A. Acceptable Manufacturers and Types:

McKinney	Trimco
P054	1001-9
P053	1001-3
PB801	1741
OP9013	1191-3
DP08	1195-2
DP04	1194-2
EG11	KE36-1

B. Push Plates:

1. McKinney type P054 6 inches by 16 inch unless otherwise indicated.
2. Where width of door stile prevents use of 6 inch wide plate, provide push plate one inch less than width of stile but not less than 4 inches wide.

C. Push Bars:

1. McKinney type PB801, unless otherwise indicated.

D. Pulls:

1. McKinney Series OP9013, unless otherwise indicated.
2. Where required, mount back to back with push bars.

E. Kick Plates and Armor Plates: Minimum of 0.050 inch thick, beveled 4 edges.

1. At single doors provide width 1-1/2 inch less than door width on stop side and one inch less than door width on face side.
2. At pairs of doors provide width one inch less than door width on both sides.
3. Height of 10 inches, unless otherwise indicated.

F. Edge Guards: Minimum .050" thick, stainless steel,

1. McKinney type EG11 x 42 inches high as noted in Hardware Groups.

2.7 COORDINATORS

A. Acceptable Manufacturers:

Trimco	Quality	Door Controls
3094 Series	CMS 500 Series	600

B. Provide 3094 Series coordinator for labeled pairs of doors equipped with automatic flush bolts and those with vertical rod/mortise lock fire exit device combinations with astragals.

C. Provide filler bars for total opening width, closer mounting brackets, carry bars, and special preparation for top latches where applicable.

2.8 DOOR CLOSERS

A. Acceptable Manufacturers and Types of Exposed Closers:

Sargent	Yale	Corbin Russwin
351/351-P10	4400/PR4400	DC8000

B. Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA.

C. All door closers shall be ANSI 156.4, Grade 1 Certified.

D. Provide drop plates, brackets, or adapters for arms as required to suit details.

E. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

F. Provide back-check for closers.

G. Provide hold-open arms where indicated.

H. Provide closers for doors as noted in Hardware Groups and, in addition, provide closers for labeled doors whether or not specifically noted in group.

I. Provide closers meeting the requirements of IBC 2003 and UL 10C positive pressure tests.

2.9 BI-FOLDING DOOR HARDWARE

A. Acceptable Manufacturers and Types:

Pemko	Grant	Lawrence
100	1260	ED600

B. Provide complete hardware sets for each opening specified with bi-folding door hardware.

C. Include track, hangers, fasteners, guides, and all hardware required for a complete installation.

2.10 WALL STOPS AND HOLDERS

A. Acceptable Manufacturers and Types:

McKinney	Door Controls	Trimco
WS01	3211	1270WXCP
DS20	3260X	1205
DS22	3267X	1207

B. Provide WS01 Series wall stop as applicable, for each door leaf except where wall stops DS20 are specified in Hardware Groups, or where conditions require the use of an overhead stop.

C. Provide 1540 Series overhead stops for doors that swing more than 140 degrees before striking a wall.

D. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.11 THRESHOLDS

A. Acceptable Manufacturers: McKinney, Pemko, and Reese Enterprises.

McKinney	Pemko	Reese
MCK171A	171A	S205A

B. Where thresholds are specified in hardware groups, provide MCK171A thresholds unless detailed otherwise.

C. Refer to drawings for special details. Provide accessories, shims and fasteners.

D. Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

2.12 WEATHERSTRIPPING

A. Acceptable Manufacturers and Product:

	McKinney	Pemko	Reese
Sweeps	MCK315CN	315CN	323A
Jambs	MCK316AV	316AV	DS75A
Door top drips	MCK346C	346C	R201A

B. Where weatherstripping is specified in hardware groups, provide MCK316AV unless detailed otherwise.

C. Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.

D. Where sweeps are specified in hardware groups, provide MCK315CN unless detailed otherwise.

E. Where rain drips are specified in hardware groups, provide MCK346C x full frame width, unless detailed otherwise.

2.13 GASKETING

A. Acceptable Manufacturers: McKinney, Pemko, and Reese Enterprises. Refer to drawings for special details. Provide accessories, shims and fasteners.

McKinney	Pemko	Reese
MCKPK55D	PK55D	F-897B

B. Where smoke gasket is specified in hardware groups, provide MCKPK55D, unless detailed otherwise.

C. Provide gaskets for 20-minute doors and doors designated for smoke and draft control.

D. Where frame applied intumescent seals are required by the manufacturer, provide gaskets that comply with UBC 7-2, 1997 and UL 10C positive pressure tests.

2.14 KEY CABINET

A. Provide key cabinets by Lund Equipment, Telkee Incorporated, or Key Control.

B. Lund Deluxe wall type cabinet, Series 1200.

C. Provide cabinet with one hook for each lock or cylinder plus at least 50 percent extra hooks.

D. Provide each hook with one non-removable security key tag and one snap-on link duplicate key tag.

E. Provide tools, instruction sheets and accessories required to complete installation.

F. Owner will place keys in key cabinet and complete index cards furnished with key system.

2.15 KEY MANAGEMENT SOFTWARE

A. Provide Key Wizardâ key management software.

B. Software shall provide tracking, issuing, collecting and transferring information regarding keys, doors, and hardware.

C. Provide training for Owner's personnel on the proper operation and application of the key management software.

2.16 FASTENERS

A. Including, but not limited to, wood or machine screws, bolts, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.

B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.

C. Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping only.

2.17 TYPICAL FINISHES AND MATERIALS

A. Finishes, unless otherwise specified:
    1. Butts: Outswinging Exterior Doors
        a. US32D (BHMA 630) on Stainless Steel
    2. Butts: Interior Doors and Inswinging Exterior Doors
        a. US26D (BHMA 652) on Steel
    3. Continuous Hinges:
        a. US28 (BHMA 628) on Aluminum
    4. Flush Bolts:
        a. US26D (BHMA 626) on Brass or Bronze
    5. Exit Devices:
        a. US32D (BHMA 630) on Stainless Steel
    6. Locks and Latches:
        a. US26D (BHMA 626) on Brass or Bronze
    7. Push Plates, Pulls and Push Bars:
        a. US32D (BHMA 630) on Stainless Steel
    8. Coordinators:
        a. USP (BHMA 600) on Steel
    9. Kick Plates, Armor Plates, and Edge Guards:
        a. US32D (BHMA 630) on Stainless Steel
    10. Overhead Stops and Holders:
        a. US26D (BHMA 626) on Brass or Bronze
    11. Closers: Surface mounted.
        a. Sprayed Aluminum Lacquer.
    12. Latch Protectors:
        a. US32D (BHMA 630) on Stainless Steel

13. Miscellaneous Hardware:
    a. US26D (BHMA 626) on Brass or Bronze

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.2 INSTALLATION

A. Install finish hardware in accordance with reviewed hardware schedule and manufacturer's printed instructions. Prefit hardware before finish is applied, remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.

B. Installation of hardware shall comply with NFPA 80 and NFPA 101 requirements.

C. Set units level, plumb and true to line and location. Adjust and reinforce attachment to substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and permanently anchor thresholds, using countersunk non-ferrous screws to match color of thresholds (stainless steel screws at aluminum thresholds).

F. Lead Protection: Lead wrap hardware penetrating lead-lined doors. Levers and roses to be lead lined. Apply kick and armor plates with 3M adhesive #1357, as recommended by 3M Co., on lead-lined doors.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.

B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING AND CLEANING

A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.

B. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.

D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

E. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

A. Provide for proper protection of items of hardware until Owner accepts Project as complete.

3.6 HARDWARE GROUPS

A. The following schedule of hardware groups shall be considered a guide only, and the supplier is cautioned to refer to general conditions, special conditions, and the preamble to this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

B. Refer to the door schedule for hardware group required at each door opening.

3.7 HARDWARE GROUPS

SET #1

Doors: 101, 101.1 PAIRS OF ALUM. /GLASS SWINGING DOORS

SET #8

Doors: 101.2, 113.1, 125 SINGLE ALUM. /GLASS DOORS

1 Mortise Cylinder	63 41	26D	SA

NOTE: Balance of hardware by aluminum door supplier. Verify cylinder quantity and type. Exit Device by Aluminum door supplier.

SET #2

Doors: 102 PAIR OF DOORS

6 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
2 Exit Device	12 63 8813 F ETL	32D	SA
2 Closer	1431 CPS	EN	SA
2 Wallstop	WS01/02	US32D	MC
2 Weather Strip	MCK316 AV		MC
1 Threshold	MCK171 A		MC

SET #3

Door: 102.1,

3 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Exit Device	12 63 8813 F ETL	32D	SA
1 Closer	1431 CPS	EN	SA
1 Weather Strip	MCK316 AV		MC

1 Threshold	MCK171 A		MC

SET #4

Doors: 103, 105, 115, 119,

3 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Lockset (Privacy)	2865U15KL	26D	SA
1 Wall Stop	WS01/02	US32D	MC
3 Door Silencers	S1M		MC
1 Threshold	MCK171 A		MC

SET #5

Doors: 104 PAIR OF DOORS

6 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Lockset (Storeroom)	2865U15KL	26D	SA
2 Wall Stop	WS01/02	US32D	MC
2 Weatherstrip			MC
1 Threshold	MCK171 A		MC

SET #6

3 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Exit Device	12 63 8813 F ETL	32D	SA
1 Closer	1431 CPS	EN	SA
1 Weather Strip	MCK316 AV		MC
1 Threshold	MCK171 A		MC

SET #7

Doors: 107, 108, 109, 110, 111, 112, 113, 114, 116, 117, 118, 120, 120.1, 122, 123, 124

3 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Lockset (Entrance)		26D	SA
1 Closer	1431 PS	EN	SA

1 Wall Stop	WS01/02	US32D	MC
3 Door Silencers	S1M		MC
1 Threshold	MCK171 A		MC

SET #9

Doors: 108.1, 110 Tornado Resistant Doors, Frames, and Hardware

3 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Lockset (Storeroom)	2865G04KL	26D	SA
1 Wall Stop	WS01/02	US32D	MC
1 Closer	1431 PS	EN	SA
1 Weatherstrip			MC
1 Threshold	MCK171 A		MC

END OF SECTION

SECTION 08800 - GLAZING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. Provide glass and glazing, complete, for each of the specific types of glazing systems specified for this project.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Aluminum Framing; Section 08400.

1.4 QUALITY ASSURANCE

A. Provide safety glass (tempered, laminated) complying with requirements of ANSI Z97.1 and CPSC 16 CFR 1201 CII.

B. Label each piece of glass designating type and thickness of glass. Do not remove label prior to installation.

C. Permanently identify each unit of tempered glass. Etch or ceramic fire identification on glass; identification shall be visible when unit is glazed.

1.5 SUBMITTALS

A. Comply with Section 01300.

B. Product Data: Submit copy of manufacturer's specifications and installation instructions for each type of glass and glazing material. Include test data or certification substantiating that glass complies with specified requirements.

C. Samples: Prior to ordering, submit minimum 6" x 6" sample of each type and thickness of glass required for review by Architect.

1.6 PROTECTION

A. Protect glass surfaces and edges at all times during the construction period. Keep glass free from contamination by materials capable of staining glass.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. PPG Industries, Inc. is the basis of design. Other manufacturers may be equal and acceptable. Any substitutions must be submitted as per Section 01300 and within 60 days of the start of construction as indicated by the date of the Notice to Proceed.

The Architect shall be the judge of the equivalency and acceptability of any substitutions.

2.2 SEALED INSULATED UNITS/GLASS MATERIALS AND PRODUCTS

A. Preassembled units consisting of the following organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other specified requirements:

1. 1" Insulated Vision Unit:
   Outer lite- 1/4" PPG SOLARGRAY, Tempered where required by code
   1/2" Airspace
   Inner lite-1/4" PPG SOLARBAN on Clear, Tempered where required by code

B. Glazed Units shall meet the following minimum design criteria:
1. SHGC = 0.25
2. Winter U-value = 0.29

2.3 GLAZING MATERIALS

A. Provide materials with proven record of compatibility with surfaces contacted in installation.

1. Glazing Sealants: Tremco "Proglaze", Bostik Chem-Calk 1200", Pecora "836", Sonneborn "Omniglaze", or other approved by system manufacturer.
2. Glazing Gaskets: Structural rubber, molded neoprene, or cellular neoprene as recommended by manufacturer of glazing system.
3. Glazing Tape: Bostik "Chem Tape 60", Pecora "Shim-Seal", or Tremco "Pre-shimmed Tremco 440 Tape".
4. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, adhesively backed on one face only, tested for compatibility with specified glazing sealants.
5. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, tested for compatibility with specified glazing sealant.
6. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.
7. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors by spot application method (25% coverage) without support, to be used in 1/8" to 1/2" thickness.

PART 3 - EXECUTION

3.1 PERFORMANCE REQUIREMENTS

A. Watertight and airtight installation of each piece of glass is required. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials, and other defects in work. The design wind speed criteria shall be 90 mph.

3.2 INSTALLATION

A. Comply with recommendations of glass manufacturers and manufacturers of sealants and other glazing materials, unless otherwise indicated or specified, including preparation of surfaces.

B. Clean channel surfaces and prime as recommended by sealant manufacturer.

C. Cut glass to size as required for measured opening, provide adequate edge clearance and glass bite all around. Cut prior to tempering.

D. Do not install sheets which have edge damage or face imperfections.

E. Miter-cut and bond (weld) ends of channel gaskets at corners to provide a continuous gasket.

F. Seal face gaskets at corners with liquid elastomeric sealant to close openings and prevent withdrawal of gaskets from corners.

G. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period.

3.3 CURING

A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

END OF SECTION

SECTION 09250 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SCOPE: Provide all work required to complete gypsum wallboard work, metal trim and accessories as indicated on the Drawings and specified.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Rough Carpentry: Section 06100

B Pre-manufactured Wood Roof Trusses: Section 06160

C. Hollow Metal Doors and Frames: Section 08110

D. Painting: Section 09900

1.03 QUALITY ASSURANCE:

A. Obtain gypsum wallboard, trim accessories, and adhesives from a single manufacturer.

B. Allowable Tolerances: 1/8" offsets between planes of board faces, and 1/4" in 8ft. for plumb, level, warp, and bow.

1.04 SUBMITTALS: Submit manufacturer's installation instructions for each gypsum wallboard component.

1.05 DELIVERY, STORAGE AND PRODUCT HANDLING: Deliver materials in original packages, containers and bundles, fully identified with manufacturer's name, brand, type and grade. Store in dry, well ventilated space, protected from the weather under cover and off the ground. Stack flat to prevent sagging. Handle to prevent damage to edges, ends and surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: U.S. Gypsum and National Gypsum are specified. Gold Bond or Georgia Pacific are acceptable.

2.02 MATERIALS:

A. Gypsum Board:

1. 5/8" Sheetrock, with tapered edges.

2. ½" Water Resistive (WR) James Hardie 3' x 5' HardieBacker 500 Ceramic Tile Backer Board with water and mold resistance.

3. Roof Cover Board @ Single Ply Membrane Roof System: Georgia Pacific Dens Deck Roof Board.

B. Trim Accessories: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide all corner beads, edge trim-beads, and one-piece control joint beads. (Type 093) Provide control joints at all walls or ceilings which exceed 20 feet in length or as otherwise noted. Verify location with Architect.

C. Fasteners: Self-drilling, self-tapping screws for power driving with special head design for gypsum- board attachment (Type S), producing surface depression for proper concealment; 1" long. Space 12" o.c. staggered at vertical joints. Use other fasteners as required.

D. Acoustical Sealant: U.S.G. Acoustical Sealant, or approved equal.

E. Exterior Insulation: As specified in Section 07214.

F. Interior Sound Batt Insulation: Provide 2 ½" sound attenuation batt insulation, By Owens Corning or equal as indicated on the Drawings

PART 3 - EXECUTION

3.01 INSTALLATION: In accordance with manufacturer's printed instructions, and as specified and as indicated on the drawings.

A. Partitions:

1. Fasten gypsum board to each side of studs, spaced 16" o.c. Provide additional studs at door and window frames.

2. At sound walls, wedge insulation between studs and fit snugly against floor and ceiling runners and against protrusions. Cut board neatly in around all openings, pipes, ducts, electrical boxes, outlets, fixtures, etc. Seal to fill all gaps and around entire perimeter with acoustical sealant, including floor and ceiling joints and intersections with vertical surfaces to provide a completely air-tight wall.

B. Furred Spaces: Type of gypsum board indicated, attached direct to structure or framing.

C. Apply gypsum board perpendicular to studs with single panels in longest length available.

D. Provide casing beads where edges of gypsum board meet dissimilar materials.

E. Fasten gypsum board to studs with screws; space screws 16" o.c. at walls.

F. Cooperate with the carpenter in placing of backing and blocking required as backing for all millwork, fixtures, fittings, and accessories. Reinforce and brace studs in partitions supporting fixtures, to provide firm backing and prevent deflection of the wall.

G. Arrange gypsum board joints on opposite sides of partitions to occur on different studs.

H. Treat all internal angles formed by the intersection of either wallboard surfaces with metal trim and/or a taped joint system as indicated or required.

I. Treat all vertical and horizontal external corners with metal bead corner reinforcement applied in accordance with manufacturer's instructions.

J. Provide vertical control joints at walls over **20 feet** long. Coordinate locations with Architect.

END OF SECTION

SECTION 09300 -TILE

PART 1 - GENERAL

1.01 SCOPE: Provide labor, materials and equipment necessary to complete porcelain tile work indicated in the Drawings and specified.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

Concrete Work: Section 03300.

1.03 QUALITY ASSURANCE:

A. Tile: The Certification mark of the Tile Council of America shall appear on each label or carton of tile. All tile shall be Standard Grade and containers grade-sealed in accordance with minimum grade specifications established in TCA 137.1. In addition to grade seal, furnish master grade certificate stating grade, kind of tile, identification marks for tile packages, name and location of job; signed by the manufacturer and the tile contractor.

B. Setting Methods: Materials and workmanship for installation of tile shall conform to recommendations set forth for conventional and/or thin-set methods in the current "Handbook for Ceramic Tile Installation" as published by the Tile Council of America, Inc., P. O. Box 326, Princeton, New Jersey 08540.

1.04 SUBMITTALS: Submit panels not less than 8 inches square for each pattern and type of tile/grout to be used.

PART 2 - PRODUCTS

2.01

B. WALL TILE: GLAZED CERAMIC WALL TILE: Glazed ceramic wall tile shall be as selected from American Olean, or equal.

1. Series: MATTE
2. Wall field tile sizes: 4 ¼“x 4 ¼”
3. Moisture absorption: less than 20%
4. Surface finish: Plain
5. Trim: Bullnose (P43C9), Bullnose Corner (Sc-886), other trim as required

2.02 SETTING MATERIALS:

A. Thin-Set Mortar: Thin-Set Mortar: Materials shall conform to requirements of ANSI Standard A118.1 for thin set mortar materials.

B. Grout: Shall be normal cementitious grout (CG1) conforming to ANSI 118.6. Color of grout to be selected by the Architect. Setting mortar and grout shall be products of the same manufacturer.

2.03 SETTING METHODS:

A. Walls adjacent to and surrounding the water closets shall be thin set ceramic tile over concrete backer board. Install backer board and tile to a height of 5'-0" over wood studs. Provide a ceramic bullnose termination at the top of the tile wainscot and a stainless steel termination channel at the bottom.

2.04 PROTECTION: Provide Schluter-Schene-E stainless steel edge protecting between tile and adjacent finishes (800) 472-4588. Provide height appropriate to conditions.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Substrate Surface:

1. Remove soap scum, wax, coatings, oil, and other contaminants from all surfaces.

B. Field Measurements/Verifications: Field measure and verify dimensions as required.

C. Do not start tile work until work of other trades which goes through or in the space behind tile has been completed.

D. Protect adjacent areas or surfaces from damage as a result of the Work of this Section.

3.02 INSTALLATION:

A. Install all tile, setting and grouting materials according to particular installation method indicated or scheduled.

B. Do not apply mortar or adhesives to surfaces covered by frost.

C. Maintain minimum temperature of 50 degrees Fahrenheit for tile installation.

D. Prevent rapid evaporation of moisture from mortar bed.

3.03 WORKMANSHIP:

A. All tile and workmanship shall be in accordance with the Tile Council of America (TCA) and in a manner conforming with the best current practice of the industry.

B. Center fields and patterns on applied areas so that no tile is less than half size.

3.04 CLEANING:

A. Immediately remove all spots, smears, stains, residues, adhesives, etc., from the work of this section and/or upon adjacent areas or surfaces.

B. Sponge and wash tile thoroughly with clear water after the grout has stiffened. Then clean by rubbing with damp cloths or sponges, and polish with clean dry cloth.

3.05 CURING: Cure tile in accordance with ANSI Standard Specifications.

3.06 SEALANT: After tile has cured apply two coats of water based silicone sealant.

3.06 PROTECTION:

A. Close off spaces in which tile is being set to traffic and other work during installation and for at least 48 hours after completion of tile work.

B. After installation and until acceptance, protect the tile from damage.

C. Remove damaged materials and replace with new, undamaged materials all at no cost to the Owner.

END OF SECTION

SECTION 09678 - RESILIENT WALL BASE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE

A. Provide resilient wall base and accessories, complete. See Finish Schedule for locations and extent of floor accessories as well as the Finish Plans A 701.

1.3 SUBMITTALS

A. Product Data: Submit copy of manufacturer's technical data, installation instructions, and maintenance instructions for each accessory.

B. Samples: Submit full color range samples for type and pattern of each accessory specified for verification by Architect.

1.4 DELIVERY AND STORAGE

A. Delivery: Deliver materials to the project site in the manufacturer's original unopened containers, clearly marked to indicate pattern gage, lot number and sequence of manufacture.

B. Storage: Store in original container at not less than 70 F for at least 48 hours before start of installation.

1.5 JOB CONDITIONS

A. Maintain minimum temperature of 70 F for minimum of 48 hours prior to installation. Maintain 70 temperature continuously during and after installation as recommended by the flooring manufacturer, but in any case not less than 48 hours.

PART 2 - PRODUCTS

2.1 RUBBER BASE

A. Flexco is basis of design, Roppe, Johnsonite, Burke, are acceptable, 4" top set cove, with preformed or molded interior and exterior corners; colors as selected and indicated on the Materials List, Section 09200.

B. Refer to the Finish Schedule and Finish Plans for specific locations.

2.3 OTHER MATERIALS

A. Provide adhesives, primers, crack fillers and other materials required but not specifically described, as recommended by the resilient flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which rubber base work is to be placed. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by flooring manufacturer. Do not proceed until unsatisfactory conditions have been corrected.

B. Use trowleable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone.

E. Broom clean or vacuum substrates to be covered immediately before installing products specified. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

3.2 INSTALLATION

A. Install products using methods indicated according to manufacturer's installation directions.

B. Resilient Base: Apply resilient base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is indicated. Install base in as long lengths as practicable. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces using a waterproof adhesive.. Do not stretch resilient base during installation.

1. Preformed Corners: Install inside and exterior corners before installing straight pieces.
2. Formed corners:
   a. Form inside corners from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of rubber base at the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate.
   b. Form outside corners from straight pieces of maximum lengths possible by shaving back of base at point where bending will occur. Remove a strip perpendicular to length of base only deep enough to produce a snug fit without bends whitening or removal of more than half the thickness of rubber base.

3.3 CLEANING

A. Immediately after installation perform the following operations:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturer of rubber base involved.
   2. Damp-wipe rubber base to remove marks and soil.

END OF SECTION

SECTION 09680 - CARPETING

PART 1 - GENERAL

1.01 SCOPE: Provide carpeting, complete, including carpet, adhesive, seaming, anchorage, edge treatment, and accessories, as indicated. Refer to Finish Schedule for carpet locations.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

N/A

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions and maintenance instructions.

B. Samples: Submit minimum 18" X 27" carpet square in color selected for Architect's verification, and 6" length of edge guards.

C. Shop Drawings: Prior to ordering carpet, submit carpet layout drawings at same scale as contract drawings, showing carpet seam locations, direction of pattern, and location and type of edge treatment.

1.04 QUALITY ASSURANCE: Installation: Use thoroughly trained and experienced carpet installers who are completely familiar with materials specified and manufacturer's recommended methods of installation for specified materials.

1.05 PRODUCT DELIVERY AND STORAGE: Deliver materials in protective wrapping, and store inside, protected from weather, moisture and soiling.

PART 2 – PRODUCTS

2.01 CARPET PRODUCT: Mohawk Group Artist’s Series or equal

Product Type	Broadloom
Construction	Pattern Loop
Fiber Type	Nylon
Dye Method	100% Solution Dyed
Gauge	1/10
Stitches Per Inch	10.0
Tufted Pile Height	4/32" (.125") - 8/32" (.250")
Tufted Yarn Weight	28.0
Finished Pile Thickness	0.123
Density	8195
Weight Density	213,070
Protective Treatments	Soil Protection
Primary Backing	Woven Synthetic

Width	12 foot
Pattern Repeat	3/4"W X 3/4"L
Recommended Installation	direct glue
Post Consumer Recycled Content	0
Post Industrial Recycled Content	10.9

2.02 CARPET SPECIFICTION:

Methenamine Pill Test (DOC FF-1-70)	Passes
Flooring Radiant Panel (ASTM E-648)	Class I
Smoke Density (ASTM E-662)	Less than 450
Static Control (AATCC-134)	Less than 3.5 kV
CRI Green Label Plus	GLP 2271

2.03 WARRANTY:

Wearability

2.02 CARPET ACCESSORIES:

A. Carpet Edge Guard: Extruded or molded vinyl or rubber carpet edge guard of size and profile indicated, in color as selected by the Architect.

B. Installation Adhesive: Water-resistant, non-staining as recommended by carpet manufacturer, which complies with requirements for installed carpet.

C. Seaming Cement: Hot-melt seaming adhesive or similar product recommended by carpet manufacturer, for taping seams and buttering cut edges of carpet backing (and bottom of face pile) at seams, to form secure seams and prevent pile loss at seams.

D. Miscellaneous Materials: As recommended by manufacturers of carpet and other carpeting products; selected by installer to meet project circumstances and requirements.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine substrates and conditions under which carpeting is to be installed. Do not proceed with installation of carpeting until unsatisfactory conditions

have been corrected. Do not install carpet over concrete with either excess moisture or dust producing surface which is not adequately sealed.

3.02 PREPARATION:

A. Repair minor holes, cracks, depressions and rough areas using material recommended by carpet or adhesive manufacturer.

B. Clean surfaces to be carpeted immediately prior to installation of carpeting materials, by vacuum cleaning.

C. Dimensions: Prior to start of carpet installation, check critical dimensions of spaces to be carpeted, to ensure that planned use of materials will fulfill requirements, including locations for seam joints and edging.

3.03 INSTALLATION: Comply with manufacturer's recommendations for glue-down installation.

A. Lay carpet to provide as few seams as possible. Cross seams are not acceptable. Maintain direction of pattern and texture. At doors, center seams under doors; do not place seams in traffic direction at doorway.

B. Extend carpet under open-bottomed obstructions and under removable flanges and furnishings and into alcoves and closets of each space.

C. Provide cut-outs where required and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.

D. Install carpet edge guard at locations where edge of carpet is exposed to traffic, except where another device, such as a threshold is indicated. Anchor edge guard to substrate.

3.04 GLUE-DOWN INSTALLATION:

A. Apply primer to entire substrate where necessary for adequate bond of carpet.

B. Fit sections of carpet into each room or space prior to application of adhesive. Trim off mill edges unless carpet has been pretrimmed. Maintain straight seams, true to lines of building.

C. Apply seaming cement on cut edges of carpet at seams, without being in evidence on face of carpet but securing base of pile at cut.

D. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps. Roll lightly to eliminate air pockets and ensure uniform total-area bond of carpet to substrate. Remove adhesive promptly from face of carpet.

3.05 CLEANING: Remove and dispose of debris and unusable scraps. Vacuum carpet using commercial machine with rotating agitator or beater nozzles. Remove spots, and replace carpet where spots can not be removed. Remove protruding face yard using sharp scissors.

3.06 PROTECTION: In public areas, provide temporary non- staining paper pathway in direction of traffic.

3.07 EXCESS CARPET: All usable pieces of carpet not necessary to complete the work are to be left on the job site and placed in an orderly manner in such area as designated by the Owner.

END OF SECTION

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.01 SCOPE: Provide painting and finishing of interior and exterior items and surfaces throughout Project, except as otherwise indicated.

A. Provide field painting of hangers, exposed steel and iron work, of primed metal surfaces and exposed-to-view prefinished metal surfaces of items, as required to match adjacent surfaces. Provide touch-up of pre-finished items as required to match original finish.

B. Do not paint acoustical ceilings, laminated plastic, aluminum flashing, brick and pre-finished items, except as noted.

1.02 SUBMITTALS:

A. Paint Schedule: Submit paint schedule listing each material cross-referenced to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

B. Samples:

1. Submit samples of finishes type and color on specified materials for verification.

2. Paint 4' X 4' test panel, for each requested, on wall surface. Do not order paint in bulk until final test panel is approved.

1.03 DELIVERY AND STORAGE: Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Provide paints, enamels, stains, varnishes, and admixtures of first line quality as manufactured by Sherwin Williams, Pratt and Lambert, Glidden or Devoe.

2.02 MATERIALS: See paragraph 3.05, SCHEDULE OF PAINT TREATMENT for materials. All finish coats shall contain mildewcides. Grind in the factory all exterior colors and interior deep tone colors. Shop mixing is not permitted. Colors as selected by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine the areas and conditions under which painting work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Starting of painting work will be construed as acceptance of the surfaces within any particular areas.

3.02 SURFACE PREPARATION: Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified. Remove all hardware, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Reinstall the removed items by workmen skilled in the trades involved, after painting is completed.

A. Cementitious Materials: Prepare cementitious surfaces to be painted by removing all chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint.

B. Wood: Clean wood surfaces of dirt, oil and other foreign substances with scrapers, mineral spirits, and sandpaper. Sandpaper smooth those surfaces exposed to view, and dust off. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, etc. Scrape and clean small, dry seasoned knots, and apply thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

C. Gypsum Wall Board: Treat all joints, nail heads and other depressions in the surface of the wallboard, in accordance with the recommended manner, with a taped joint system by the gypsum wallboard manufacturer. Do not paint over gypsum wallboard work until taped joints are thoroughly dry.

D. Ferrous Metals: Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent clean, and touch up with the same primer as the shop coat.

E. Galvanized Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum based solvent.

F. Aluminum Surfaces: Clean free of oil and surface contaminates with an acceptable non-petroleum based solvent.

G. Previously Coated Surfaces: All surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint. Glossy surfaces of old paint films must be clean and dull before repainting. Wash thoroughly and dull by sanding. Remove sanding dust. Spot prime all bare areas with the appropriate primer. Check for compatibility of the previously painted surface with the new coating by apply a test patch of 2-3 square feet. Allow to dry thoroughly, check adhesion.

3.03 APPLICATION:

A. Apply paint by brush, roller, spray, or other acceptable practice in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheeps wood as recommended by the manufacturer for material and texture required.

B. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sand paper, or rub surfaces with pumice stone where required to produce an even smooth surface in accordance with the coating manufacturer's directions.

C. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

D. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent of that of flat surfaces.

3.04 CLEAN-UP: Thoroughly clean all spots, smears, spills, etc., and remove from the site all discarded paint materials, rubbish cans and rags at the end of each work day.

3.05 PAINTING AND FINISHING SCHEDULE:

A. <u>Exterior Surfaces to be Painted</u>: <u>No., Description of Coats</u>:

1. Exterior ferrous metals, a) 1 coat Rust Primer.

	Hollow Metal Doors and Frames, Door Grilles, Metal Louvers, Trim, Handrails, Steel Grating, Steel Angles, Beams, Plates	b) 2 coats Ext. Alkyd Gloss Enamel MWF 4.0 mils. NOTE: Items with factory primed finish are to be spot primed

NOTE: Paint Roof Stacks, Exhaust Vents to match Roof color.

2.	All ferrous metals (Steel Angles, Framing, Straps, Bolts, Plates, etc.) in contact with aluminum.	a) 2 coats Rust primer.
3.	Parking Lot and Drive Striping, Handicapped Parking Symbol.	a) 4" wide lines to be Traffic Marking Paint (Yellow). Paint with a mechanical traffic line painting machine.

B.	<u>Interior Surfaces to be Painted</u>:	<u>No. Description of Coats</u>:
1.	Gypsum Wallboard.	a) 1 coat latex wall primer, blended with vinyl ready-mix mud to produce a "medium orange-peel" finish. Sample to be approved by Architect. b) 2 coats Pro-mar EG-Shel Latex Enamel. 1.5 mils, DFT/Coat.
2.	Gypsum Wallboard Ceilings primer, 1.1 mils, DFT.	a) 1 coat latex wall b) 2 coats Pro-Mar 200 EG-Shel Enamel, 1.5 mils DFT/Coat.
3.	Gypsum Wallboard in Wet Areas (Toilets & Break Room).	a) 1 coat latex wall primer, 1.1 mils DFT. b) 2 coats Tile Clad II Epoxy, 4.0 mils DFT/Coat

4.	Interior Exposed Wood Surfaces to be stained.	a) 1 coat Rez Stain in color as selected by Architect. b) 1 coat Sealer-Finish and lightly sand. c) 2 coats 77-9 Rez Satin Finish Polyurethane. Lightly sand between coats.
5.	Interior Exposed Ferrous Metals including Hollow Metal Doors and Frames, Wall Grilles, Louvers. Exposed Structure	a) 1 coat rust primer. b) 2 coats Pro-mar 200 Alkyd Interior Enamel 1.7 mils DFT/Coat.
6.	Interior Exposed CMU:	a) 1 coat latex wall primer 1.1 mils DFT b) 2 coats Tile Clad II Epoxy, 4.0 mils DFT/Coat

END OF SECTION

SECTION 10350 - FLAGPOLE

PART 1 – GENERAL

1.01 SCOPE: Furnish and install fiberglass flagpole, complete where indicated on the drawings.

1.02 SUBMITTALS:

A. Manufacturer's Data: Submit copy of manufacturer's technical data, installation instructions and maintenance instructions.

PART 2 – PRODUCTS

2.01 DESCRIPTION: Flagpole shall be Fiberglass – Entasis tapered ground set, Model Number SCF 30, as manufactures by Ewing International Corp., 2316 Delaware Avenue, Buffalo, New York, or approved equal.

A. Flagpole: Shall have 30' of exposed height above ground. The outside butt diameter shall be 6 ½ ".
B. Base: Shall be Ewing Model #B-5., fixed anchor type.
C. Finish: Shall be coloured polyurethane. Color to be permanently impregnated in pole.
D. Ball: Shall be 6" anodized aluminum.
E. Flagpole Fittings: Shall be external revolving truck system.

PART 3 – EXECUTION

3.01 INSTALLATION: Install as indicated in the Drawing in accordance with manufacturer's recommendation.

END OF SECTION

SECTION 10440 - INTERIOR SIGNS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Provide room identification signs, room numbers, and other identifying devices as specified.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:

Flush Wood Doors: Section 08210

1.03 SUBMITTALS: Provide samples of letter style, size, and letter/number spacing of each device required or specified.

1.04 PRODUCT HANDLING:

A. Protection: Protect identifying devices before, during, and after installation. Protect installed Work of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements at Contractor's expense.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Where a definite item is specified, it is not the intention to discriminate against any "approved alternate" product made by another manufacturer. Intention is to set or maintain a definite standard. Open competition is expected but in all cases, complete data must be submitted for comparison. Make no substitution unless authorized in writing by Owner.

B. All internal signage unless otherwise indicated shall be architectural signage as manufactured by Innerface International, 5320 Webb Parkway, Lilburn, Georgia 30247; ASI Sign Systems, Inc., 548 West 28th. St.,New York, NY 10001; APCO, 388 Grant St.,SE, Atlanta, Georgia 30312-2227; or Owner approved alternate.

2.02 SELECTION AND LOCATION: As soon as practicable after drawings are completed a copy shall be provided to Owner for purposes of indicating signage type, lettering style, wording/numbers, and location.

2.03 SIGNAGE:

A. Signage wording, numbering, and locations shall be as determined by the Owner. Signage shall include above door letters/numbers, on-door letters/numbers, beside door letters/ numbers, wall-mounted or ceiling-hung signage, and other signage as indicated.

B. The Contractor shall allow in his bid the dollar amount of five hundred dollars $ 500.00 for the purchase and installation of signs of the quantity and type of signs as selected by Owner. The allowance shall include sales tax and delivery to the job site.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS:

A. Prior to Work of this section, carefully inspect installed work of other trades and verify other Work is complete to point where installation of this Work may properly commence.

B. Do not install identifying devices until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Contractor shall install identifying devices specified in locations indicated. If not indicated, as directed by Owner's representative.

B. Install in strict accordance with manufacturer's recommendations and instructions. Anchor devices securely in place.

END OF SECTION

SECTION 10800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE: Provide and install toilet accessories complete for each toilet room as indicated on the Drawings and specified.

1.02 SUBMITTALS:

A. Manufacturer's Data: Submit technical data and installation instructions for each toilet accessory.

B. Shop Drawings: Submit shop drawings showing grab bar installation. Provide setting drawings, instructions and directions for installation of anchorage devices in other work.

1.03 JOB CONDITIONS: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Bobrick is specified. Bradley and ASI are acceptable.

2.02 MATERIALS:

A. Stainless Steel: ANSI Type 302/304, No. 4 finish, 22 gage minimum.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install toilet accessory units in accordance with manufacturer's instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit.

B. Install units plumb and level, firmly anchored in locations as recommended by manufacturer to meet ADA requirements or at heights indicated on the Drawings.

All units shall be accessible in accordance with the recommendations of the Americans with Disabilities Act, Standards for Accessible Design, latest edition.

END OF SECTION

SECTION 10950 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 SCOPE: Furnish materials, labor, and equipment necessary to furnish and install all fire extinguishers and cabinets as indicated in the Drawings and specified.

1.02 SUBMITTALS:

A. Manufacturer's Data: Submit manufacturer's product data and installation instructions.

B. Submit shop drawings indicating locations, materials, anchorages and supports.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Fire Extinguisher and Cabinets:

1. Fire Extinguisher Cabinets shall be J.L. Industries "Academy", 2038 non rated, semi recessed, glass view panel, stainless steel door with die cut letters in black reading "Fire Extinguisher".

2. Fire extinguishers shall be "Cosmic E" Series Model #10.

3. Install where indicated in the Drawings, Fire Extinguishers and Cabinets as manufactured by J.L. Industries, Division of J.N. Johnson, 4450 West 78th Street, Bloomington, Minn., or approved equal.

4. The Contractor shall be responsible for certifying and filling all Fire Extinguishers and assuring the Owner that all Extinguishers are in safe, operable condition at the time of completion of all work.

PART 3 - EXECUTION

Mount top of cabinet 5'-4" A.F.F., or handle at 48" A.F.F., which ever is less.

END OF SECTION

SECTION 10990 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SCOPE: Furnish miscellaneous specialties as indicated on the Drawings or specified herein.

1.02 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and installation instructions for accessory item specified.

B. Shop Drawings: Submit shop drawings indicating location, details of installation, finishes, and other pertinent data. Provide structural calculations for items requiring such.

PART 2 - PRODUCTS

2.01 KNOX BOXES

Provide two (2) Knox Boxes as manufactured by Knox Company, telephone 800-552-5669, model 3200 recessed mounted: 5” high x 4” wide x 3 ¼” deep with 7” x 7” flange aluminum box with 3200 recessed mounting kit. The sleeve assembly, shall be 16GA. Corrugated Galv. Steel tube.

2.02 INDIVIDUAL STAINLESS STEEL LETTERS

Supply and Install 12” tall, pin mounted individual stainless steel letters as depicted on Sheet A2.1. Letters shall be fabricated from C301 solid stainless steel plate, 12” tall, min. ¼” thick with bead blasted sides and brushed faces. Letters shall be pin mounted, raised 1” clear from the surface of the brick veneer

PART 3 - EXECUTION

3.01 INSTALLATION: Install each accessory in compliance with manufacturer's instruction and final shop drawings, at locations and mounting heights indicated on the Drawings or as directed by the Architect.

END OF SECTION

Forrest City
New City Hall
Forrest City, Arkansas
Volume 2

Prepared for:

CITY OF FORREST CITY
FORREST CITY, ARKANSAS

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ETC ENGINEERS & ARCHITECTS, INC.
1510 SOUTH BROADWAY
LITTLE ROCK, AR 72202

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SECTION 220100 BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and all other Division 22 and 23 Sections.

1.2 SUMMARY

A. Provide mechanical and plumbing systems indicated on drawings, specified, or reasonably implied, complete. The omission of specific reference to any part of the work necessary for complete systems installation and proper operation shall not be interpreted as relief from providing such parts of the work necessary.

B. Refer to drawings and specifications for Owner-furnished equipment. Provide work indicated and specified to install Owner-furnished items.

1. Provide supplies, stops, and trap for Owner-furnished sinks; verify if faucets, drain, and tailpiece are Owner furnished or shall be furnished and installed by the Contractor.

C. Verify equipment provided under other divisions of the specifications which require mechanical and plumbing connections, and controls.

D. This section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this section to expand the requirements specified in Division 01:

1. Code Requirements, Fees, and Permits
2. Product Substitution Procedures
3. Submittals
4. Drawings
5. Local Conditions
6. Temporary Heat, Cooling and Ventilation
7. Cutting and Patching
8. Rough Ins
9. Quality Assurance
10. Record Documents
11. Operation and Maintenance Manual(s)
12. System Demonstration and Owner’s Instruction

13. Installations
14. Warranties
15. Cleaning

1.3 CODE REQUIREMENTS, FEES, AND PERMITS

A. Provide work in accordance with applicable codes, rules, ordinances, industry standards, utility company regulations, and regulations of local, state and federal governments and other authorities having lawful jurisdiction.

B. Unless otherwise noted, conform to latest editions and supplements of following codes, standards or recommended practices as adopted by the authority having jurisdiction:

1. Arkansas State Plumbing Code
2. Arkansas Mechanical Code
3. International Building Code
4. International Mechanical Code
5. International Plumbing Code
6. AMCA - Air Moving and Conditioning Association
7. ASA - American Standards Association
8. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
9. ASME - American Society of Mechanical Engineers
10. ASTM - American Society of Testing Materials
11. AWWA - American Water Works Association
12. NBS - National Bureau of Standards
13. NEMA - National Electrical Manufacturer's Association NFPA - National Fire Protection Association
14. SMACNA - Sheet Metal and Air Conditioning Contractor's National Association (HVAC Duct Construction Standards)
15. UL - Underwriters' Laboratories, Inc.
16. AGA - American Gas Association Laboratories
17. NSF - National Sanitation Foundation

C. In case of differences between building codes, regulations, laws, local ordinances, industry standards, and utility company regulations, and the Contract Documents, the most stringent governs. Promptly notify Architect in writing of any such difference.

D. Obtain required permits in connection with this work and pay fees in connection therewith. Arrange with the serving utility companies for the connections to utilities and pay charges for same including inspection fees and meters if and when required.

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Manufacturers of other products than those listed may be considered. Submit substitution request in compliance with Division 01 Sections for "Substitutions & Product Options." All Divisions 22 and 23 substitution requests shall be submitted at least five working days prior to bid. Requests for substitution received by Engineer later than 5 days prior to bid opening may be rejected without review.

1.5 SUBMITTALS

A. The format and quantity of the submittals shall comply with the requirements of Division 1, General Requirements and other Divisions 22 and 23 sections.

B. Refer to individual sections of Divisions 22 and 23 for additional and specific requirements.

C. Product Data:

1. Arrange product data in sets/electronic files with sections corresponding to and in same order as Division 22 and 23 sections.
2. Provide an index of the sections at the front of the submittal listing the section number and the items included in each section.
3. Provide cover sheet for each section, listing each type of material or equipment, designation and model number if any, and the name of the supplier.
4. Clearly indicate sizes, capacities, brand names, motor HP, accessories, options, materials, gages, dimensions, and other pertinent information. Pertinent information shall include items scheduled on the drawings as a minimum. Clearly indicate designations corresponding to drawings and schedules.
5. Provide performance charts and curves, installation instructions, and complete wiring diagrams. Provide pump curves for all pumps indicating operating point and impeller size as a minimum. Provide fan curves for all fans indicating operating point. Provide charts, tables, and data necessary to establish air and water pressure drops for all air and water system components.

D. Submittals failing to meet specified requirements will be returned without review or approval.

1.6 DRAWINGS

A. Drawings show general arrangement of piping, ductwork, and equipment systems. Follow closely as actual building construction and work of other trades will permit.

B. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over mechanical drawings.

C. Due to the small scale of mechanical and plumbing drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves and accessories required to meet the conditions.

D. Record differences between mechanical work as installed and as shown in Contract Documents on a set of Record Documents. Return these prints to Architect at completion of project. Refer to additional information in this section.

E. Do not scale mechanical drawings for dimensions. Accurately lay out work from dimensions indicated on structural and architectural drawings, and as verified in the field.

1.7 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work.

B. No subsequent compensation will be considered for any consequence related to failure to determine site conditions or nature of existing or new construction.

C. Locations and elevations of the various utilities and services included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work.

1.8 CONCRETE BASES

A. Coordinate the size and location of concrete bases with actual equipment provided and the Architectural and Structural Plans.

B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes of the Project.

1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section, "Cast-in-Place Concrete."

1.9 TEMPORARY HEAT, COOLING AND VENTILATION

A. Comply with requirements of Division 01 Construction Facilities and Temporary Controls.

B. Do not use the permanent heating systems as a temporary source of heat during construction. When the building is substantially complete and only after approval of the Architect may the permanent building systems be utilized.

C. Where advantageous to facilitate installation of finishes and ceiling tile, use of permanent cooling and/or ventilation systems may be permitted, subject to demonstration that construction has progressed to a point where system equipment, ductwork, and controls will not be contaminated with construction material. Use in this case will require written approval of the Architect. Where use is not permitted, provide necessary temporary cooling/dehumidification and/or ventilation at no additional cost to the Owner.

1.10 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, “Structural Welding Code—Steel.”

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications.”

1. Comply with provisions in ASME B31 Series, “Code for Pressure Piping.”
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at the expense of the Contractor. No additional money will be paid due to lack of coordination between the trades. If

minimum energy ratings or efficiencies are specified, the submitted equipment shall comply with the requirements.

1.11 RECORD DOCUMENTS

A. Comply with requirements of Division 01 Section "Administrative Requirements."

B. During the progress of the work, keep an accurate record of all changes and corrections from the Contract Documents. Record of changes shall be kept by accurately making all changes on a set of prints and specifications during the progress of the job.

C. For final submittal, provide reproducible documents.

D. In addition to the requirements of Division 01 Section, "Administrative Requirements,", indicate as a minimum the following:

1. Exact location of underground utility services and their connections to utility mains. Valve locations shall be indicated.
2. Indicate actual inverts of all underground piping.
3. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
4. Mains and branches of piping systems, with valves and control devices located and numbered, with concealed unions located, and with items requiring maintenance located, including traps, strainers, expansion compensators, and tanks. Provide valve location diagrams, complete with valve tag chart.
5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
6. Location of access panels.
7. Approved substitutions, contract modifications, and actual equipment and materials installed.
8. Revise mechanical schedules shown on drawings to reflect actual equipment installed. Include actual equipment model numbers.

1.12 OPERATIONS AND MAINTENANCE MANUAL

A. Comply with the requirements of Division 01 Section, "Administrative Requirements."

B. Provide two bound copies of Operations and Maintenance Manual for mechanical systems.

C. Manual shall include tabbed sections for individual systems and equipment with index of sections at the front of the binder. Index shall include name and phone number of nearest supplier and manufacturer's representative.

D. Include the following, as a minimum, in the manual:

1. List of mechanical equipment used indicating name, model, serial number and nameplate data of each item together with number and name associated with each system item.
2. Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
3. Description of equipment and system function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
4. Manufacturer's printed operating procedures to include equipment and system start up, break in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
6. Provide schematic control diagrams for each system showing location of control devices with correct operating settings marked for each device. Include related electrical devices, including firestats, fuses, interlocks, switches and relays. Provide drawings of each temperature control panel indicating components and their function.
7. Provide copy of valve tag schedule.
8. Provide copies of equipment start-up logs.
9. Provide copy of final Test and Balance report.
10. Provide complete set of approved shop drawings and product data as an appendix to manual.

1.13 SYSTEM DEMONSTRATION AND OWNER'S INSTRUCTIONS

A. Demonstrate to the satisfaction of Owner's representative that mechanical systems and components are operating properly.

B. Utilizing Operation and Maintenance Manual, provide Owner's representative(s) instruction in the operation and maintenance of mechanical systems.

C. Provide minimum of [eight] hours formal instruction balanced as required between classroom type instruction and "hands-on" instruction for each of the following:

1. General mechanical and plumbing systems and equipment.
2. Control system.

D. Provide additional instruction where necessary to fully prepare Owner to operate and maintain mechanical systems and components.

E. Refer to individual Divisions 22 and 23 sections for additional requirements

F. Demonstration and instruction to begin after final Test and Balance report is complete and before final payment.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Section "Materials and Installation." "CUTTING AND PATCHING." In addition to the requirements specified in Division 01, the following requirements apply

B. Perform cutting, fitting, and patching of electrical equipment and materials required to:

1. Remove existing work not to be reused or reconnected after completion.
2. Uncover Work to provide for installation of ill-timed Work.
3. Remove and replace defective Work.
4. Remove and replace Work not conforming to requirements of the Contract Documents.
5. Remove samples of installed Work as specified for testing.
6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.

C. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers.
2. Patch specified finished surfaces and building components using new materials specified for the original installation and experienced installers.
3. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Refer to Division 01 Section “Definitions And Standards" for definition of experienced "Installer."

G. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

H. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

I. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

J. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

3.2 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to drawings and equipment specifications in Divisions 02 through 23 for rough-in requirements.

3.3 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components to allow for plumbing and mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of plumbing and mechanical materials and equipment or efficient flow of the Work. Give particular

attention to large equipment requiring positioning prior to closing in the building.

6. Coordinate the cutting and patching of building components to accommodate the installation of plumbing and mechanical equipment and materials.
7. Where mounting heights are not detailed or dimensioned, install overhead equipment to provide the maximum headroom possible.
8. Coordinate the installation of plumbing and mechanical materials and equipment above ceilings with suspension system, electrical equipment and systems, structural components, and the work of all other trades involved with the project.
9. Coordinate connection of plumbing systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service. Do not interrupt electrical or telephone service without Owner's written permission.
10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
12. Install plumbing and mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
13. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors" and Division 22 Section "Access to Mechanical Work."
14. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.4 WARRANTIES

A. Refer to the Division 01 Section: Submittals, Materials And Equipment, and Project Closeout for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 22 and 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item, product, or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

3.5 CLEANING

A. Refer to the Division 01 Section, "Execution & Closeout Procedures": Project Closeout for general requirements for final cleaning.

B. Clean all diffusers prior to final acceptance.

END OF SECTION
121110:1611041444

SECTION 220300 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

1.2 SUMMARY

A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specification sections.

C. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

1.3 REFERENCES

A. NEMA Standards MG 1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NEC) (NFPA 70).

F. IEEE Standard 112: Tests for Motor Efficiency.

1.4 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled where standards exist.

PART 2 - PRODUCTS

2.1 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
   1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
   2. Motor sized shall be large enough so that the driven load will not require the motor to operate in the service factor range.
   3. Two-speed motors shall have two separate windings on poly-phase motors.
   4. Temperature Rating: 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
   5. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hours for manually controlled motors.
   6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
   7. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
   8. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
   9. Bearings:
      a. Ball or roller bearings with inner and outer shaft seals.
      b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
      c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
      d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.

   10. Enclosure Type:
      a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
      b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
      c. Weather protected Type I for outdoor use, Type II where not housed.

11. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
12. Noise Rating: "Quiet".
13. Noise Rating: "Quiet" rating for motors located in occupied spaces of building.
14. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.
15. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Manual switches shall have:
   1. Pilot lights and extra positions for multi-speed motors.
   2. Overload Protection: Melting alloy type thermal overload relays.

B. Motor Connections: Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.3 DISCONNECT SWITCHES

A. Non-fusible Switches: For equipment two horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than two horsepower, switches shall be the same as fusible type.

PART 3 - EXECUTION - Not Applicable

END OF SECTION
121213:1611041452

SECTION 220450 ACCESS TO MECHANICAL WORK

PART 1 - GENERAL

1.1 RELATED WORK

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

B. This section is a Division 23 Basic Mechanical Materials and Methods section, and is a part of each Division 23 section making reference to access to mechanical work.

C. Section 09 9100; Painting.

D. Section 04 2000; Unit Masonry.

1.2 SUMMARY

A. Extent of access to mechanical work required by this section includes, but is not limited to, providing access panels in ceilings, walls, and floors for dampers, valves, terminal air boxes, filters, and similar equipment which requires periodic adjustment, maintenance, or other access.

B. Where not specifically indicated on the drawing or specified in other sections, but required for access to mechanical work, provide access panels as specified herein.

C. Coordinate locations of access panels with other trades. Obtain approval from Architect for locations of access panels which are not indicated on the drawings.

D. Types of access to mechanical work specified in this section include the following:

1. Access doors in walls, ceilings, and floors.
2. Removable cover plates in walls, ceilings, and floors.

E. Access requirements within mechanical work, to mechanical or electrical components within work, are specified in other Division 23 sections and are not work of this section.

1.3 SUBMITTALS

A. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings,

templates, instructions and directions for installation of anchorage devices. Transmit copy to installer.

B. Source quality-control reports.

C. Field quality-control reports.

D. Operation and Maintenance Manual Data: Submit parts lists for system materials and products. Include this data, product data and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

E. Record Drawings: At project closeout, submit record drawings of installed access assemblies and components, show exact location in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products for access to mechanical work of sizes, types, ratings, and materials required, whose products have been is satisfactory use in similar service for not less than 5 years.

B. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated or required for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.

C. Source Limitations: Obtain each type of access assembly through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section “Substitutions & Product Options.”

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. General: Where floors, walls and ceilings must be penetrated for access to mechanical work, provide types of access doors indicated, including floor doors if any. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

PART 3 - EXECUTION

3.1 ACCESS TO MECHANICAL WORK

A. Comply with manufacturer's instructions for installation of access doors, floor doors, and removable access plates. Installation shall be performed by the various trades that normally perform the particular items of work.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

D. Remove or replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION
121119:1611041411

SECTION 220523 VALVES

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Valves furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 23 sections.

C. Section 22 1116; Domestic Water Piping.

1.2 SUMMARY

A. Types of valves specified in this section include gate valves, globe valves, drain valves, ball valves, butterfly valves, and swing, wafer, and lift check valves.

1.3 SUBMITTALS

A. Product Data: Submit Manufacturer's Technical Product Data, specifications, installation instructions, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve.

B. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

C. Welding Certificates.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts list for each type of valve. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout, submit record drawings of installed valves and their exact location in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Firms regularly engaged in the manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Marking of Valves: Comply with MSS SP-25.

C. Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.

D. Valve Listing: For valves on fire protection piping, provide listing by UL and Associated Factory Mutual Fire Insurance Companies.

E. Valves Installed in Boiler Rooms: Comply with ASME Boiler and Pressure Vessel Code where applicable.

F. Valve Types: Provide valves of same type by same manufacturer.

G. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

H. Comply with NSF 61, “Drinking Water System Components – Health Effects,” for all components that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 VALVES

A. Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 GATE VALVES

A. Do not use gate valves in any domestic water piping system.

2.3 DRAIN VALVES

A. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

1. Crane
2. Milwaukee
3. Nibco

B. For Low Pressure Drainage Service:
   1. Threaded Ends 2" and Smaller: Class 125, bronze body screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.
   2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.

2.4 BALL VALVES

A. Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

B. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Crane
   2. Milwaukee
   3. Nibco

C. Comply with the following standards:
   1. Bronze Valves: ASTM B62.
   2. Cast-Iron Valves: MSS SP-72.
   3. Steel Valves: ANSI B16.34.

D. For Domestic Water Service:
   1. Threaded Ends 2" and Smaller: Class 125, bronze 2 piece body, chrome plated brass ball, bronze stem and replaceable Teflon seats and seals.
   2. Soldered Ends 2" and Smaller: Class 125, bronze 2 piece body, chrome plated brass ball, bronze stem and replaceable Teflon seats and seals.

2.5 SWING CHECK VALVES

A. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Crane
   2. Milwaukee
   3. Nibco

B. General: Construct pressure containing parts of valves as follows:
   1. Bronze Valves, 125 or 150 psi: ANSI/ASTM B 62.
   2. Metallic Seated Bronze Valves, 200 or 300 psi: ANSI/ASTM B 61.
   3. Iron Body Valves: ANSI/ASTM A 126, Class B.

C. Comply with MSS SP-80 for design, workmanship, material and testing.

D. Construct valves of pressure castings free of any impregnating materials. Construct valves of bronze, regrinding, with seating angle 40° to 45°, unless composition disc is specified.

E. Provide stop plug as renewable stop for disc hanger, unless otherwise specified. Construct disc and hanger as separated parts, with disc free to rotate. Support hanger pins on both ends by removable side plugs.

F. For Domestic Water Service:
   1. Threaded Ends 2" and Smaller: Class 150, bronze body, screwed cap, horizontal swing, Y-pattern, bronze disc.
   2. Soldered Ends 2" and Smaller: Class ?, bronze body, screwed cap, horizontal swing, Y-pattern, bronze disc.
   3. Flanged Ends 2-1/2" and Larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, Y-pattern, cast-iron disc.

2.6 VALVE FEATURES

A. Provide valves with features indicated to comply with installation requirements. Comply with ANSI B31.1.

B. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.

C. Drain: Comply with MSS SP-45, and provide threaded pipe plugs complying with Division 22 Section, “Domestic Water Piping.”

D. Flanged: Valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5, (steel), or ANSI B16.24 (bronze).

E. Valve Ends:
   1. Threaded: Comply with ANSI B2.1.
   2. Butt-Welding: Comply with ANSI B16.25.
   3. Socket-Welding: Comply with ANSI B16.11.
   4. Solder Joints: Comply with ANSI B16.18.

F. Single Flange: Valves including bolt holes dimensioned for mating flanges.

G. Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry.

H. Non-Metallic Disc: Non-metallic material selected for service indicated in accordance with manufacturer's published literature.

I. Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

J. Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

K. Mechanical Actuator: Factory-fabricated gears, gear enclosure, external chain attachment and chain designed to provide mechanical advantage in operating valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Except as otherwise indicated, comply with the following requirements:
   1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
   2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

D. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

E. Mechanical Actuators: Install mechanical actuators with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, boiler rooms; and where recommended by valve manufacturer because of valve size, pressure differential or other operating condition making manual operation difficult.

F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
   1. Tube Size 2" and Smaller: Soldered-joint valves.

2. Pipe Size 2" and Smaller: Threaded valves, grooved-end valves, butt-welding valves, socket-welding valves, flanged valves, flangeless valves, or single flanged valves.
3. Pipe Size 2-1/2" and Larger: Grooved-end valves, butt-welding valves, socket-welding valves, flanged valves, wafer valves, single flange valves, hub-and-spigot valves, or mechanical joint end valves.

G. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

H. Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

I. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

J. Fluid Control: Except as otherwise indicated, install ball, globe, and butterfly valves to comply with ANSI B31.1. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valves.

K. Installation of Check Valves:
1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

END OF SECTION
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SECTION 220529 SUPPORTS, ANCHORS & SEALS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Supports, anchors, and seals furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 23 sections.

C. Section 03 3000; Cast-In-Place Concrete.

1.2 SUMMARY

A. Extent of support, anchors, and bases required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of supports, anchors, and bases specified in this section include horizontal-piping hangers and supports, vertical-piping clamps, hanger-rod attachments, building attachments, saddles and shields, spring hangers and supports, flashing materials, miscellaneous materials, anchors, and equipment bases.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of equipment.

B. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

C. Welding Certificates.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout submit record drawings of installed systems, show exact locations in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of supports, anchors, and seals, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

C. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports, anchors, and seals.

E. UL and FM Compliance: Provide products which are Underwriters Laboratories listed and Factory Mutual approved.

F. Manufacturers Standard Society of the Valve and Fitting Industry, Inc., (MSS) Standard Compliance:
1. Provide pipe hangers and supports of which materials, design, and manufacturer comply with ANSI/MSS SP-58.
2. Select and apply pipe hangers and supports, complying with MSS SP-69.
3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
4. Terminology used in this section is defined in MSS SP-90.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
1. Adjustable Steel Clevises: MSS Type 1.
2. Alloy Steel Pipe Clamps: MSS Type 2.

3. Steel Double Bolt Pipe Clamps: MSS Type 3.
4. Steel Pipe Clamps: MSS Type 4.
5. Pipe Hangers: MSS Type 5.
6. Adjustable Swivel Pipe Rings: MSS Type 6.
7. Adjustable Steel Band Hangers: MSS Type 7.
8. Adjustable Band Hangers: MSS Type 9.
9. Adjustable Swivel Rings, Band Type: MSS Type 10.
10. Split Pipe Rings: MSS Type 11.
11. Extension Split Pipe Clamps: MSS Type 12.
12. U-Bolt: MSS Type 24.
13. Clips: MSS Type 26.
14. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
15. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.
16. Single Pipe Rolls: MSS Type 41.
17. Adjustable Roller Hangers: MSS Type 43.
18. Pipe Roll Stands: MSS Type 44.
19. Pipe Rolls and Plates: MSS Type 45.
20. Adjustable Pipe Roll Stands: MSS Type 46.

2.2 VERTICAL-PIPING CLAMPS

A. Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
   1. Two-Bolt Riser Clamps: MSS Type 8.
   2. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-ROD ATTACHMENTS

A. Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
   1. Steel Turnbuckles: MSS Type 13.
   2. Steel Clevices: MSS Type 14.
   3. Swivel Turnbuckles: MSS Type 15.
   4. Malleable Iron Sockets: MSS Type 16.
   5. Steel Weldless Eye Nuts: MSS Type 17.

2.4 BUILDING ATTACHMENTS

A. Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
   1. Concrete Inserts: MSS Type 18.
   2. Top Beam C-Clamps: MSS Type 19.
   3. Side Beam or Channel Clamps: MSS Type 20.
   4. Center Beam Clamps: MSS Type 21.
   5. Welded Attachments: MSS Type 22.
   6. C-Clamps: MSS Type 23.
   7. Top I-Beam Clamps: MSS Type 25.
   8. Side I-Beam Clamps: MSS Type 27.
   9. Steel I-Beam Clamps W/Eye Nut: MSS Type 28.
   10. Steel WF-Beam Clamps W/Eye Nut: MSS Type 29.
   11. Malleable Beam Clamps: MSS Type 30.
   12. Steel Brackets: One of the following for indicated loading:
      a. Light Duty: MSS Type 31.
      b. Medium Duty: MSS Type 32.
      c. Heavy Duty: MSS Type 33.

   13. Side Beam Brackets: MSS Type 34.
   14. Plate Lugs: MSS Type 57.
   15. Horizontal Travelers: MSS Type 58.

2.5 SADDLES AND SHIELDS

A. Except as otherwise indicated, provide saddles for all piping 4" and larger and shields for piping 3" and smaller under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Elcen Metal Products Co.
   2. Grinnell

C. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

D. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

E. Thermal Hanger Shields: Constructed of 360° insert of high density, 100 psi, water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

2.6 SPRING HANGERS AND SUPPORTS

A. Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

B. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Elcen Metal Products Co.
   2. Grinnell

C. Hangers and Supports shall be of the type indicated below:
   1. Restraint Control Devices: MSS Type 47.
   2. Spring Cushion Hangers: MSS Type 48.
   3. Spring Cushion Roll Hangers: MSS Type 49.
   4. Spring Sway Braces: MSS Type 50.
   5. Variable Spring Hangers: MSS Type 51; preset to indicated load and limit variability factor to 25%.
   6. Variable Spring Base Supports: MSS Type 52; preset to indicated load and limit variability factor to 25%; include load flange.

2.7 CONSTANT SUPPORTS

A. Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.
   1. Horizontal Type: MSS Type 54.
   2. Vertical Type: MSS Type 55.
   3. Trapeze Type: MSS Type 56.

2.8 FLASHING MATERIALS

A. Furnish flashings, as required for the roof/membrane type, for each penetration of mechanical systems through roofs and waterproof membranes to Installer responsible for installation of flashings, as specified in Division 07 Installation; not work of this section.

2.9 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

C. Heavy-Duty Steel Trapezes: Where several pipes occur at the same elevation, trapeze type hangers may be used. Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proceed with installation of hangers supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through opening at top of inserts.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-protection piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

E. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

F. Insulated Piping: Comply with the following installation requirements:
1. Clamps: Attach clamps, including spacers (if any), to piping with clamps wrapping around the insulation; do not crush the pipe insulation and do not exceed pipe stresses allowed by ANSI B31.
2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install plastic insulation saddles. Wood saddles shall not be used.
3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.4 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer to loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.5 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

END OF SECTION
121127:1611041516

SECTION 220553 MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division 23 sections.

1.2 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of identification devices specified in this section may include painted identification materials, plastic pipe markers, plastic tape, underground-type plastic line market, valve tags, valve schedule frames, engraved plastic-laminate signs and plasticized tags.

1.3 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copy for Maintenance Manuals as specified in Division 1.

D. Maintenance Material: Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes. Where stenciled markers are provided, clean and retain stencils after completion of

stenciling and include used stencils in maintenance materials, along with required stock of stenciling paints and applicators.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of ? system products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Source Limitations: Obtain each type of label through one source from a single manufacturer.

C. Comply with ANSI Standard A13.1 for lettering size, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

B. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
1. Brady Corporation
2. Seton Identification Products

C. Painted Identification Materials:
1. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork, and not less than 3/4" high letters for access door signs and similar operational instructions.
2. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
3. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ANSI A13.1 for colors.

D. Plastic Pipe Markers: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

1. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125°F or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
2. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   b. Adhesive lap joint in pipe marker overlap.
   c. Laminated or bonded application of pipe marker to pipe (or insulation).

3. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   a. Laminated or bonded application of pipe marker to pipe (or insulation).
   b. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

4. Lettering: Manufacturer's standard pre-printed nomenclature which best described piping system in each instance, as selected by Architect in cases of variance with names as shown or specified.
5. Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length. Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

E. Plastic Tape: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
   1. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
   2. Color: Comply with ANSI A13.1, except where another color selection is indicated.

F. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed detectable plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

G. Valve Tags:
   1. Plastic Valve Tags: Provide manufacturer's standard solid plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener. Provide 1-1/8" square white tags with black lettering.

2. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

H. Engraved Plastic-Laminate Signs: Provide engraving stock melamine plastic laminate, complying with Fed. Spec. L-P-387, in the sizes indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
1. 1/16" or1/8" thick, except as otherwise indicated. 1/16" thick for units up to 20 sq. in. or 8" length; 1/8" for larger units.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

I. Plasticized Tags: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, or plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.2 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment. Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Ductwork Identification: Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).
1. Location: In each space where ductwork is exposed, in occupied areas only, or concealed only by removable ceiling system, locate signs near points

where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacings along exposed runs.

2. Access Doors: Provide stenciled or plastic-laminated type signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
3. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification in lieu of specified signs, at Installer's option.

C. Piping System Identification: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2" beyond ends of lettering.
2. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
3. Stenciled markers, black or white for best contrast, wherever continuous color-coded painting of piping is provided.

D. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, mechanical rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings.

E. Underground Piping Identification: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type, detectable, plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

F. Valve Identification: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated

equipment units, plumbing fixture faucets, convenience and hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

1. Tagging Schedule: Comply with requirements of "Valve Tagging Schedule" at end of this section or per the plans.
2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

G. Mechanical Equipment Identification: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gages, thermometers and similar units.
3. Fuel-burning units including boilers, furnaces, heaters, and absorption units.
4. Pumps, compressors, chillers, condensers, and similar motor-driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
6. Fans, blowers, primary balancing dampers and mixing boxes.
7. Packaged HVAC central-station and zone-type units.
8. Tanks and pressure vessels.
9. Strainers, filters, humidifiers, water treatment systems and similar equipment.

H. Optional Sign Types: Where lettering larger than 1" height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

I. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

J. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

K. Optional Use of Plasticized Tags: Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may,

at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

END OF SECTION
130125:1611041521

SECTION 220700 MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SCOPE

A. Piping System Insulation: Domestic water piping systems,

1.2 RELATED WORK

A. Section 22 0529; Supports, Anchors and Seals.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of insulation products of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least 3 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of insulation. Include the manufacturer's product number, thickness, thermal conductivity, jackets (both factory and field applied, if any) and furnished accessories for each system requiring insulation.

B. Certifications: Submit manufacturers' certifications to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

C. Shop Drawings: Submit shop drawings for insulation installations including:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.
7. Detail field application for each equipment type.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

B. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

C. Protect insulation against dirt, water, chemical or mechanical damage. Do not install damaged insulation.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Supports, Anchors & Seals."

B. Coordinate clearance requirements with piping Installer for piping insulation application, and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Armstrong World Industries, Inc.
   2. Certainteed
   3. Johns-Manville
   4. Owens-Corning Fiberglas
   5. Pittsburg Corning Corp.
   6. Knauf Fiberglass
   7. Rubatex
   8. Armacell

2.2 PIPE INSULATION MATERIALS

A. Fiberglass Pipe and Pipe Fitting Insulation: Inorganic glass fibers bonded with a thermosetting resin with a density of 10 pounds per cubic foot per ASTM C541 Class I.
   1. Operating Temperature Range: 0 to 850° F per ASTM C411.
   2. Jacket Permeance: 0.02 perms per ASTME 96 Process A.
   3. Thermal Conductivity: k equal to 0.23 BTU·in/hr·ft^2 ·°F at a mean temperature of 75° per ASTM C680.
   4. Jacket Temperature Limitation: -20°F to 150°F per ASTM C1136.
   5. Composite Surface Burning Characteristics: Flame spread of 25 and developed smoke rating of 50 per UL 723 and ASTM E84.
   6. Jacket shall consist of a factory applied fire retardant self-sealing, laminated glass fiber, reinforced vapor barrier.

B. Flexible Elastomeric Pipe Insulation: Flexible expanded closed cell structure with a smooth skin on both sides per ASTM C534.
   1. Thermal Conductivity: 0.25 BTU·in/h· ft^2 ·°F at 75°F and 90°F per ASTM C177 or C518.
   2. Water vapor permeability: 0.05 Perm·in per ASTM E96 Procedure A.
   3. Composite Surface Burning Characteristics: Flame spread of 25 and a developed smoke rating of 50 per ASTM E84.
   4. Water Absorption: 0.2% by volume per ASTM C209.
   5. Do <u>not</u> use for any systems with operating temperatures above 140° F.
   6. Polyolefin shall not be considered an equal and is not allowed for any piping system.
   7. Adhesive: Solvent based contact adhesive as recommended by the manufacturer.

C. PVC Premolded Piping, Fitting and Valve Covers:
   1. Fabricated from one piece polyvinyl chloride plastic (PVC).
   2. Piping covers shall have a minimum thickness of 20 mils.
   3. Fitting and valve covers shall have a minimum thickness of 30 mils.

D. Accessories and Attachments:
   1. Canvas cloth and Tape: Woven canvas fiber fabrics, plain weave, pre-sized a minimum of 8 ounces per square yard. Tape shall be 4" wide.
   2. Aluminum Bands: 3/4" wide, 0.007 inch thick.
   3. Wire: 14 gauge nickel copper alloy, 16 gauge soft-annealed stainless steel or 16 gauge soft-annealed galvanized steel.
   4. Corner Angles: 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch kraft paper.
   5. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for the insulation type and thickness.

E. ADA Lavatory Piping Protection as indicated on the Plans and the Following:
   1. Lavatory Piping Wrap: Minimum 1/8" thick rigid high impact, stain resistant, white PVC cover with internal reusable fasteners. Piping wrap shall fit all 1-1/4" or 1-1/2" trap configurations and all 3/8" or 1/2" angle stop assemblies and conform to all ADA Requirements. Piping wrap shall be a TrueBro Lav Guard 2 or an engineer approved equivalent.

F. Staples, Bands, Wires, and Cement shall be as recommended by the insulation and/or jacket manufacturer for the applications indicated.

G. Adhesives, Sealers, and Protective Finishes shall be as recommended by the insulation and/or jacket manufacturer for the applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with the requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment 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.

3.2 PREPARATION

A. Surface Preparation: Clean, dry and remove foreign materials such as rust, scales and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements that come in contact with stainless steel with de-ionized water only.

3.3 GENERAL

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

B. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 65 degrees F.

C. Install insulation on pipe systems subsequent to testing and acceptance of tests.

D. Install insulation continuous through all walls, floors, hangers and supports.

E. Provide saddles, shields, metal protectors and other appurtenances necessary to prevent crushing of insulation at hangers, rollers, supports and anchors. Provide rigid insulation blocks at saddles.

F. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

G. Install insulation with smooth, straight, and even surfaces.

H. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

I. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

J. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

K. Apply adhesives and coating at manufacturer's recommended coverage-per-gallon rate.

L. Keep insulation materials dry during application and finishing.

M. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
   1. Fibrous glass ducts; metal ducts with duct liner, factory-insulated flexible ducts; factory-insulated plenums, casings, terminal boxes, and filter boxes and sections; testing laboratory labels and stamps; nameplates and data plates; access panels and doors in air distribution systems; sanitary drainage and vent piping, unless indicated otherwise; drainage piping located in crawl spaces, unless indicated otherwise; below grade piping, unless indicated otherwise; chrome-plated plumbing pipes and fittings from face of wall to fixture, except

for plumbing fixtures for the disabled; piping specialties including air chambers, unions, strainers, check vales, plug valves, flow regulators, hot piping within radiation enclosures or unit cabinets, cold piping within unit cabinets provided piping is located over drain pan.

3.4 PLUMBING PIPING SYSTEM INSULATION

A. Cold Piping: Insulate domestic cold water piping. Insulate with 1" thick fiberglass with factory applied vapor barrier or 1/2" thick flexible unicellular insulation.

B. Hot Piping: Insulate domestic hot water piping, domestic hot water recirculating piping, and exposed drains with 1" thick fiberglass for pipe sizes up to and including 6", 1-1/2” thick fiberglass for pipe sizes over 6”, or 1" thick flexible unicellular for pipe sizes up to and including 2" (largest size permitted).

3.5 INSTALLATION OF PIPING INSULATION

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors, hangers, supports and similar piping penetrations, except where otherwise indicated.

H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.

I. Insulation joints: For hot pipes, apply 3 inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

J. Provide a PVC jacket on all insulated pipe below 9'-0" above the finish floor where exposed in occupied spaces.

3.6 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION
130124:1611041532

SECION 221116 DOMESTIC WATER PIPING SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 0519; Meters and Gages.

C. Section 22 0529; Supports, Anchors and Seals.

D. Section 22 0540; Expansion Compensation.

E. Section 22 0553; Mechanical Identification.

F. Section 22 0700; Mechanical Insulation.

G. Section 22 1119; Piping Specialties.

H. Trenching and backfill required in conjunction with exterior water piping is specified in applicable Division 02 sections.

I. Trenching and backfill required in conjunction with domestic water piping inside of building foundations is specified in applicable Division 02 sections.

1.2 SUMMARY

A. Extent of domestic water piping systems work is indicated on drawings and schedules and by requirements of this section.

B. Applications for domestic water piping systems include the following:
1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Exterior water piping.
4. Domestic recirculating-water piping.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of piping and fitting.

B. Shop Drawings: Submit shop drawings for piping layouts, showing piping materials, sizes and locations. Show interface and spatial relationship between piping and approximate structures.

C. Welding Certificates.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for piping system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout, submit record drawings of installed piping systems, show exact location and route in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of piping materials products of types, materials 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 on projects with work similar to that required for this project.

C. Source Limitations: Obtain each type of piping material through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Plumbing Code Compliance: Comply with applicable portions of The International Plumbing Code pertaining to plumbing materials, construction and installation of products.

F. Source Quality-Control Reports.
   1. PEX piping:
      a. The PEX tubing and fitting manufacturer shall maintain a third party listing of the tubing and fittings. The tubing and fittings shall be certified in accordance with ANSI/NSF 14/61 to verify suitability to transport potable water. The tubing and fittings shall have the mark

"NSF-pw", "cNSF® us pw-G", or "NSF 61" permanently marked on the product to verify the material listing.

b. The manufacturer of the PEX tubing and fittings shall maintain a quality control program in accordance with ISO 9001 or NSF International in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard. The tubing and fittings shall be certified as complying with NSF 14.

G. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of domestic water piping systems.

H. Comply with NSF 61, "Drinking Water System Components - Health Effects," for all components that will be in contact with potable water.

I. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

J. PDI Compliance: Comply with applicable Plumbing and Drainage Institute standards pertaining to products and installation of soil and waste piping systems.

K. Local Utility Compliance: Comply with requirements of the local utility company(ies).

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by the installer to comply with the installation requirements. Provide sizes and types matching piping and equipment connections. Provide fittings of materials which match pipe materials used in domestic water piping systems unless noted otherwise. Where more than one type of materials or products are indicated, the selection is the installer's option.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with Division 22 Section, "Mechanical Identification," in accordance with the following listings:
1. Domestic Water Piping: Plastic pipe markers.
2. Domestic Water Valves: Valve tags.
3. Water Service: Underground-type plastic line markers.

2.3 BASIC PIPE, TUBE, AND FITTINGS: Provide pipe, tube, and fittings complying with the following:

A. Above Grade Domestic Water Piping:
   1. Tube Size 4" and Smaller: Copper tube and fittings per ASTM B88 and ASME B16.22.
      a. Wall Thickness: Type L, hard-drawn temper.
      b. Fittings: Wrought-copper, solder-joints.

B. Below Grade Water Piping:
   1. Tube Size 4" and Smaller: Copper tube and fittings per ASTM B88 and ASME B16.22.
      a. Wall Thickness: Type K soft-annealed temper or Type K hard drawn copper tube.
      b. Fittings: Wrought-copper fittings with silver brazed joints. Silver brazing shall be equal to SIL-FOS 2 or FOS FLO 7.

   2. 1 ½” - 3”, SDR-21, PVC pipe per ASTM D2241, Class 200, Bell and Spigot with rubber gasketed joints and matching fittings. Provide concrete blocking at all tees and elbows.

2.4 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Division 22 Section, "Piping Specialties," in accordance with the following listing:
   1. Pipe escutcheons.
   2. Low-pressure Y-type pipeline strainers.
   3. Dielectric unions.
   4. Drip pans.
   5. Pipe sleeves.
   6. Sleeve seals.

B. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Amtrol, Inc.
   2. Smith (Jay R.) Mfg. Co.
   3. Wade Div.
   4. Tyler Pipe.
   5. Zurn.
   6. Sioux Chief.

C. Water Hammer Arresters: Provide piston-type water hammer arresters, type L copper tube body with a poly piston with two EPDM O-rings, MIP thread fitting, pressure rated for 250 psi, tested and certified in accordance by ASSE to

the ANSI/ASSE 1010 Standard. Sizes shall be in accordance with Plumbing and Drainage Institute Standard WH-201.

2.5 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

C. Piping Connectors for Dissimilar Non-Pressure Pipe: Fernco, Inc., or an engineer approved equivalent; elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

2.6 BASIC SUPPORTS, ANCHORS, AND SEALS

A. Provide supports, anchors, and seals complying with Division 22 Section, "Supports, Anchors, and Seals," in accordance with the following listing:
   1. Adjustable steel clevises, adjustable roller hangers, and adjustable pipe roll stands for horizontal piping hangers and supports.
   2. Two-bolt riser clamps for vertical piping supports.
   3. Concrete inserts, C-clamps, and steel brackets for building attachments.
   4. Protection shields for insulated piping support in hangers.
   5. Copper flashings for piping penetrations through exterior surfaces.

2.7 BASIC VALVES

A. Provide valves complying with Division 22 Section, "Valves," in accordance with the following listing:
   1. Sectional Valves:
      a. 4" and Smaller: Ball Valves.

   2. Shutoff Valves:
      a. 4" and Smaller: Ball Valves.

   3. Drain Valves:
      a. 4" and Smaller: Ball Valves.

   4. Check Valves: Swing Check Valves, all sizes.

2.8 SPECIAL VALVES

A. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   1. Bell & Gossett
   2. ITT Fluid Handling Div.
   3. Hammond Valve Corp.
   4. American Air Filter Co.
   5. Milwaukee Valve Co., Inc.
   6. Sarco Co.
   7. Taco, Inc.
   8. Griswold Controls Co.

B. Auto-flow Control Valves
   1. General Specifications
      a. Automatic flow control valve cartridges shall automatically control flow rates with ±5% accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 3 PSID to actuate the mechanism.
      b. Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
      c. Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance. (Consult the factory for details).
      d. All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale.

   2. Isolator Series Valve
      a. Isolator series valves, sizes 1/2" through 1-1/2", shall have a ASTM brass alloy body, rated at no less than 400PSI/250°F. Isolator series valves, sizes 1-1/2" Large through 3", shall have a CAST brass alloy body, rated at no less than 275PSI/250°F. These sizes shall be constructed in a one-piece body to include a handle ball valve, a flow control cartridge assembly, dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes combined with a manual air vent, and a union end which will accept various end pieces. The IY shall include a removable 20 mesh stainless steel strainer. Available flow rates shall be from 0.25 GPM to 160.0 GPM. Refer to the plans for the required flow rates.
      b. The body design shall allow inspection or removal of cartridge or strainer without disturbing piping connections.
      c. The body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall

include two Teflon seals and one EPDM o-ring for protection against chemicals and modulating temperature.

d. The valve shall come fully assembled and be permanently marked to show direction of flow; shall have a body tag to indicate flow rate and model number.

C. Hydrants and Hose Bibbs: Provide products complying with Division 22 Section, “Plumbing Equipment & Fixtures.”

2.9 BASIC PUMPS

A. Provide inline booster pumps, for hot water recirculating, complying with Division 23 Section, "Pumps."

2.10 BACKFLOW PREVENTERS

A. The double check valve assembly shall consist of two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be replaceable. Service of all internal components shall be through a single access bronze or stainless steel access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves and four top mounted resilient seated test cocks. The assembly shall meet the requirements of: ASSE Std. 1015 and AWWA Std. C510.
   1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
      a. FEBCO
      b. Ames
      c. Watts Regulator Co.

2.11 BASIC EXPANSION COMPENSATION

A. Provide expansion compensation products complying with Division 22 Section, “Expansion Compensation," in accordance with the following listing:
   1. Expansion compensators for hot water and hot water recirculating piping.
   2. Pipe alignment guides.

2.12 BASIC METERS AND GAGES

A. Provide meters and gages complying with Division 22 Section, "Meters and Gages" in accordance with the following listing:
   1. Pressure gages.
   2. Glass thermometers.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. 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.

B. 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.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

3.2 INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B30 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations, or if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Electrical Equipment Spaces: Do not run piping above electric panels or through transformer vaults and other electrical or electronic equipment spaces and enclosures.

D. Piping System Joints: Provide joints of type indicated in each piping system.
   1. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where

recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Weld pipe joints in accordance with recognized industry practice and as follows:
   a. Weld pipe joints only when ambient temperature is above 0°F where possible. Bevel pipe ends at a 37.5° angle, smooth rough cuts, and clean to remove slag, metal particles and dirt.
   b. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
   c. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
   d. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
   e. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.

3. Weld pipe joints of steel water pipe in accordance with AWWA C206.
4. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

E. Install gray and ductile cast-iron water mains and appurtenances in accordance with ANSI/AWWA C603.

3.3 INSTALLATION OF EXTERIOR WATER PIPING

A. Install exterior water service piping system in compliance with local governing regulations.

B. Street Main Connection: Obtain the required permits in connection with the required work and coordinate with the Utility Company for the installation of the water service as shown on the plans.

C. Water Service Piping: Extend water service piping from meter of size and in location indicated to water service entrance at building. Provide a sleeve in the foundation wall for water service entry; make entry watertight. Provide valve at water service entry inside building; refer to the plans for information.

D. Copper Tube: Install in accordance with recommended procedures of the Copper Development Association.

E. Sterilization: At completion of water service line installation, flush and sterilize in conformance with AWWA C-601 to satisfaction of local authorities having jurisdiction.

3.4 CLEANING, FLUSHING, INSPECTING

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items. Inspect pressure piping in accordance with procedures of ANSI B30.

B. Disinfect water mains and water service piping in accordance with AWWA C601.

3.5 PIPING TESTS

A. Notify Architect at least 24 hours before performing leak test.

B. Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time. Required test periods is 2 hours. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

C. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.6 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Division 22 Section, “Mechanical Identification.”

3.7 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division 22 Section, "Piping Specialties."

B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.8 INSTALLATION OF SUPPORTS, ANCHORS, AND SEALS

A. Install supports, anchors, and seals in accordance with Division 22 Section, “Supports, Anchors, and Seals."

3.9 INSTALLATION OF VALVES

A. Install valves in accordance with Division 22 Section, "Valves."

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

E. Check Valves: Install on discharge side of each pump and elsewhere as indicated.

F. Balance/Automatic Flow Control Valves: Install in each hot water recirculating loop and elsewhere as indicated.

3.10 INSTALLATION OF PUMPS

A. Install pumps in accordance with Division 23 Section, "Pumps.”

B. Provide the following controls for each hot water recirculating pump. Refer to Division 26 section for wiring of controls; not work of this section.
   1. Time clock for continuous operation during occupied hours, coordinate with the electrical contractor for the time clock specifications.
   2. Immersion aquastat to start pump at 130°F (54°C) and stop pump at 140°F (60°C). Seven-day time clock and separate on-auto-off switch.

3. Relays required for above.

3.11 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated and where required by the codes. If required, pipe relief outlet to nearest floor drain.

3.12 INSTALLATION OF METERS AND GAGES

A. Install meters and gages in accordance with Division 22 Section, "Meters and Gages."

3.13 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated but in no case smaller than required by The International Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection. Provide drain valve on drain connection.

3.14 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION
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SECTION 221119 PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 22 sections.

C. Section 22 1116; Domestic Water Piping Systems.

D. Section 22 4200; Plumbing Equipment and Fixtures.

1.2 SUMMARY

A. Extent of piping specialties required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of piping specialties specified in this section include pipe escutcheons, pipeline strainers, dielectric unions, drip pans, sleeves, and sleeve seals.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, and installation instructions for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

C. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for each required piping specialty. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing the contents.

D. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

E. Welding Certificates.

F. Source Quality-Control Reports.

G. Field Quality-Control Reports.

H. Record Drawings: At project closeout, submit record drawings of installed specialties, show exact location in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties 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 on projects with piping specialties work similar to that required for this project.

C. Source Limitations: Obtain each type of piping specialty through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA.

G. Comply with NSF 61, "Drinking Water System Components – Health Effects," for all components that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 MANUFACTURED PIPING SPECIALTIES

A. Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections.

B. Pipe Escutcheons
1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an inside diameter closely fitting pipe outside diameter, or outside of

pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

a. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide solid, non-hinged cast brass or sheet brass escutcheons.
b. Pipe Escutcheons for Dry Areas: Provide steel solid, non-hinged escutcheons with a set screw.

2. One-Piece, Brass, Deep-Pattern Type: Piping with fitting or sleeve protruding from wall.
3. One-Piece, Cast-Brass Type: With a set screw: Polished Chrome-plated (finished spaces); Rough brass (unfinished service spaces).
4. One-Piece, Floor-Plate Type: Cast-iron floor plate.

C. Y-Type Pipeline Strainers:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   a. Armstrong.
   b. Sarco.
   c. Metraflex.

2. Strainers shall comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide 125 psi working pressure strainers for all services with Type 304 stainless steel screens, with 0.045" perforations.
   a. Threaded Ends, 2" and Smaller" Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
   b. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
   c. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

D. Dielectric Unions:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
   a. FMC Corp.
   b. PSI Industries
   c. Stockham Valves and Fittings.

2. Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

E. Vacuum Breaker: Provide a vacuum breaker to prevent back-siphonage of

potentially contaminated water into the domestic water piping for each plumbing fixture or piece of equipment having a submerged inlet or attached hose end as required by any local and state health authorities.

2.2 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide ABS plastic drip pans or drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:
1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe with plain ends and an integral water stop, unless otherwise indicated.
4. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
1. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. Unit shall be equal to a unit manufactured by Thunderline.

2.3 PIPE SPECIALTIES

A. Unions:
1. 2” and smaller copper pipe shall be brass solder joints rated for 150 psi working pressure.
2. 2” and smaller steel pipe shall be screwed, malleable iron brass to steel joints for 150 psi working pressure.

B. Flanges:
1. Flanges shall be forged steel rated for 150 psi working pressure per ANSI B16.5. Bolts for flanges shall be made of bolt steel and shall have clean cut threads with upset square heads and semi-flush hexagonal cold pressed nuts.

2. Flange connections shall be constructed of high pressure graphite 1/16” sheet packing or rubber, both rated for temperatures of up to 200°F per ANSI B16.21.

PART 3 - EXECUTION

3.1 INSTALLATION OF MANUFACTURED PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and in flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2" and smaller installed ahead of control valves feeding individual terminals. Provide drain line from shutoff valve to plumbing drain, full size of blow down connection. Locate y-type strainers in supply line ahead of pumps, and elsewhere as indicated, if integral strainer is not included in equipment.

C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment. Provide drip pans under each fan coil unit and duct coil installed above finished ceiling in addition to factory drain pan furnished with unit or coil. Provide drip pans elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members except as detailed on drawings, or as reviewed by Architect. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Install iron-pipe sleeves at exterior penetrations, both above and below grade. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.

C. Sleeve Seals: Install with mechanical sleeve seals. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

END OF SECTION
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SECTION 221123 NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 09 9100; Painting.

C. Section 22 0529; Supports, Anchors and Seals.

D. Section 22 0553; Mechanical Identification.

E. Section 22 1119; Piping Specialties.

1.2 SUMMARY

A. Extent of natural gas piping system work is indicated on drawings and schedules and by requirements of this section.

B. Gas Pressure and Definitions

1. Low-Pressure Gas Piping System: Operating at pressure of 13” W.C. or 1/2 psi, or as indicated on drawings.
2.
3. Gas Service: Pipe from the gas main to the building being served. Service includes gas service valves, pressure regulator and meter.
4. Gas Piping System: Pipe within the building that conveys gas from point of delivery to points of usage. Piping includes dielectric fitting and gas valve immediately downstream from point of delivery.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for fuel gas piping systems materials and products.

B. Welding Certificates.

C. Source quality-control reports.

D. Field quality-control reports.

E. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for gas piping system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

F. Record Drawings: At project closeout, submit record drawings of installed gas piping systems, show exact location and route of the piping in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of natural gas piping products of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. ANSI Code Compliance: Comply with applicable provisions of ANSI B31.2 "Fuel Gas Piping."

C. National Fuel Gas Code Compliance: Comply with applicable provisions of NFPA 54 (ANSI Z223.1) "National Fuel Gas Code" and ANSI Z223.1a "Supplement to National Fuel Gas Code."

D. Local Utility Compliance: Comply with requirements of local utility.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide materials and products complying with ANSI B31.2 where applicable; base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections. Provide fittings of materials which match pipe materials used in gas piping systems.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with Division 22 Section, "Mechanical Identification," in accordance with the following listing:

1. Building Distribution Piping: Pipe markers.
2. Gas Valves: Valve tags.

2.3 BASIC PIPE, TUBE, AND FITTINGS

A. Provide pipe, tube, and fittings complying with the following listing:

1. Gas Service Piping:

a. All Pipe Sizes: Black steel pipe, Schedule 40, wrought-steel butt-welded fittings. Machine wrap pipe using 50% overlay wrap, with polyvinyl chloride tape. Hand wrap fittings using 90% overlay wrap extending 6" beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions.
b. Pipe Sizes ½” Through 12”: Polyethylene plastic gas pressure pipe, tubing and fittings complying with ASTM D2513.

2. Building Distribution Piping:

a. Low pressure (1/2 psi or less) Gas Systems:

(1) Above Grade Piping:

(a) Pipe size 2” and smaller: black steel pipe, schedule 40, malleable iron threaded fittings and joints in ducted return plenums only, provide wrought steel butt-welded fittings and joints in return air plenums.
(b) Pipe size 2-1/2” and larger: Black steel pipe, schedule 40, with wrought steel butt-welded fittings and joints.

2.4 BASIC PIPING SPECIALTIES

A. Provide pipe escutcheons, pipe sleeves, and sleeve seals complying with Division 22 Section, "Piping Specialties."

B. Underground Transition Risers shall be a schedule 40 steel with an epoxy coated case complying with ASTM D 2513.

2.5 BASIC SUPPORTS, ANCHORS, AND SEALS

A. Provide supports, anchors, and seals complying with Division 22 Section, "Supports, Anchors, and Seals."

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Division 22 Section, "Mechanical Identification."

3.2 INSTALLATION OF NATURAL GAS PIPING

A. Install natural gas distribution piping in accordance with the following requirements and in accordance with applicable codes and local utility requirements.

B. Obtain the required permits in connection with the required work and coordinate with the utility company for the installation of the gas service as shown on the plans.

C. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

D. Remove cutting and threading burrs before assembling piping.

E. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

F. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

G. Ground gas piping electrically and continuously within project and bond tightly to grounding connection.

H. Install drip-legs in gas piping where required by code or regulation.

I. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.

J. Use dielectric unions where dissimilar metals are joined together.

K. Install piping with 1" drop in 60' pipe run (0.14%) in direction of flow.

L. Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hot water piping above 200°F(93°C)

M. For piping buried in building substrate, or below floor slabs, install in welded conduit, ventilated to outdoors on both ends, and tested to same requirements as gas piping.

N. All exterior gas piping shall be painted. Refer to Division 09 Section "Painting." Paint all gas piping on the roof OSHA Safety Yellow, all other above grade piping shall be painted gray.

3.3 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division 22 Section, "Piping Specialties."

3.4 INSTALLATION OF SUPPORTS, ANCHORS, AND SEALS

A. Install supports, anchors, and seals in accordance with Division 22 Section, "Supports, Anchors, and Seals."

3.5 PIPING TESTS

A. Test natural gas piping in accordance with ANSI B31.2.

B. Use only leak detector solution for detecting leaks in piping. Dish soap or window cleaner shall not be used.

3.6 SPARE PARTS

A. Furnish to Owner, with receipt, two valve wrenches for each type of gas valve installed.

END OF SECTION
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SECTION 221316 SOIL & WASTE PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 0529; Supports, Anchors and Seals.

C. Section 22 0553; Mechanical Identification.

D. Section 22 0700; Mechanical Insulation.

E. Section 22 1119; Piping Specialties.

F. Section 22 4200; Plumbing Equipment and Fixtures.

G. Section 33 3100; Sanitary Utility Sewerage Piping.

1.2 SUMMARY

A. Extent of building soil, waste and drain piping system work, is indicated on drawings and schedules, and by requirements of this section.

B. Applications for soil, waste and drain piping systems include the following:
   1. Above ground soil, waste, drain and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps, and connections to fixtures and drains.
   2. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, terminating as indicated on the drawings.

C. Exterior sanitary sewer system is specified in applicable Division 33 Section, “Sanitary Utility Sewerage Piping,” and is included as work of this section.

D. Trenching and backfilling required in conjunction with underground building drain piping is specified in the applicable portions of the following, Division 02, and Division 31 Section, “Earthwork,” and is included as work of this section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of piping and fitting.

B. Source Quality-Control Reports

C. Field Quality-Control Reports

D. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for system materials and products. Include this data, product data, and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing the contents.

E. Record Drawings: At project closeout, submit record drawings of installed waste and vent piping systems, show exact location of associated equipment and piping runs in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Firms regularly engaged in manufacturer of system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of pipe and fittings through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code pertaining to plumbing materials, construction and installation of products.

F. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of soil and waste piping systems.

G. PDI Compliance: Comply with applicable Plumbing and Drainage Institute Standards pertaining to products and installation of soil and waste piping systems.

H. Local Utility Compliance: Comply with requirements of the local utility company(ies).

PART 2 - PRODUCTS

2.1 SOIL & WASTE PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper

selection as determined by the installer to comply with the installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste piping systems. Unless noted otherwise where more than one type of materials or products are indicated, the selection is the installer's option.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with Division 22 Section, "Mechanical Identification," in accordance with the following listing:
   1. Above Ground Soil, Waste, and Vent Piping: Plastic pipe markers.
   2. Underground Building Drain Piping: Underground-type plastic line markers.

2.3 BASIC PIPE, TUBE & FITTINGS

A. Provide pipe, tube, and fittings complying with the following

B. Above Ground Piping Within Buildings:
   1. Pipe Size 8" and smaller: Polyvinyl chloride plastic pipe (PVC) shall not be installed in air plenums, unless wrapped with an appropriate insulation, per Division 22 Section "Mechanical Insulation".
      a. Wall Thickness: Schedule 40 solid core per ASTM D2665. Cellular core PVC pipe shall not be an acceptable substitution for solid core PVC pipe.
      b. Fittings: DWV Socket type, solvent cemented joints per ASTM D2466.

   2. Pipe Size 10" and Smaller: Hubless cast-iron soil pipe for use in return air plenums. All cast iron pipe soil pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute (CISPI).
      a. Pipe Class: Service weight per CISPI 301.
      b. Fittings: Hubless cast-iron soil pipe fittings, no-hub joints, with rubber gaskets per ASTM C564 and stainless steel, cast iron, or FM-type heavy duty couplings.

C. Underground Building Drain Piping:
   1. Pipe Size 8" and Smaller: Polyvinyl chloride plastic pipe (PVC).
      a. Wall Thickness: Schedule 40 solid core per ASTM D2665. Cellular core PVC pipe shall not be an acceptable substitution for solid core PVC pipe.
      b. Fittings: DWV socket type solvent cemented joints per ASTM D2466.

2.4 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Division 22 Section, "Piping Specialties," in accordance with the following listing:

   1. Pipe Escutcheons.
   2. Pipe Sleeves.

3. Sleeve Seals.

2.5 BASIC SUPPORTS, ANCHORS & SEALS

A. Provide supports, anchors, and seals complying with Division 22 Section, "Supports, Anchors and Seals," in accordance with the following listing:
   1. Adjustable steel clevises, steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.
   2. Two-bolt riser clamps for vertical piping supports.
   3. Concrete inserts, C-clamps, and steel brackets for building attachments.
   4. Copper flashings for piping penetrations.

2.6 DRAINAGE PIPING PRODUCTS

A. Provide factory-fabricated drainage piping products of size and type indicated below and complying with Division 22 Section, "Plumbing Equipment & Fixtures."

B. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

C. Floor Cleanouts: Cast-iron body and frame; cleanout plug; adjustable threaded housing round top.
   1. Nickel Bronze Top: Manufacturer's standard cast unit of the pattern specified, with recess to receive 1/8" thick floor finish, standard non-slip scored or abrasive satin finish top, or a carpet flange and carpet marker as required by the plans, locations and finishes.
   2. Cast Iron Top for Mechanical Spaces Only: Manufacturer's standard cast unit of patter specified, exposed flush type with a standard non-slip scored or abrasive finish.

D. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

E. Flashing Flanges: All roof drains and plumbing piping passing through the roof membrane shall be flashed under Division 07 Section, "Flashing & Sheet Metal." The contractor shall insure that all building envelope penetrations are properly flashed and made weather tight.

F. Manufacturer, Subject to compliance with requirements, shall be one of the following or an engineer approved equivalent:
   1. Josam Mfg. Co.
   2. Smith (Jay R.) Mfg. Co.
   3. Wade Div.
   4. Tyler Pipe
   5. Zurn Industries
   6. Hydromechanics Div.

2.7 FLOOR DRAINS

A. Provide floor drains of size as indicated on the plans and complying with the plumbing fixture schedule and Division 22 Section, “Plumbing Equipment & Fixtures.”

B. All floor drains shall be by the same manufacturer.

C. Furnish and install a deep seal “P” trap at each floor drain.

2.8 TRAPS

A. All fixtures having waste connection shall be trapped with the water seal located as close as possible to the fixture. Provide all required traps including traps not furnished in combination with the fixture or equipment.

B. Traps for lavatories or sinks shall be chrome plated 17 gauge brass unless noted otherwise on the plans.

2.9 BACKWATER VALVES

A. The backwater valve shall have a cast iron body with backwater valve and threaded cast iron cover.

B. Install components in accordance with manufacturer's instructions and approved product data submittals.

C. Set plumb, level, and rigid.

PART 3 - EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Division 22 Section, “Mechanical Identification.”

3.2 ıNSTALLATION OF SOIL & WASTE ABOVE GROUND PIPING

A. Install soil and waste piping in accordance with The International Plumbing Code.

3.3 INSTALLATION OF BUILDING STORM, WASTE, OR DRAIN PIPING

A. Install underground building drains as indicated and in accordance with International Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and

other superfluous materials as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

B. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger unless noted otherwise or a greater slope is required by the applicable code(s).

C. The size of the storm, waste, drain and vent stacks shall be as indicated on the drawings, but shall not be less than required by any applicable code.

D. All below grade piping shall be continuously bedded with depressions for hubs on compacted sand or gravel to undisturbed soil for a minimum depth of 6” under pipe. All trenches for under-slab piping shall be backfilled with gravel up to the bottom elevation of the slab.

E. Connections to soil, waste and drain stacks shall be at 45 degrees; those to vent stack may be at 45 degrees or 90 degrees except vent stacks shall be connected at 45 degrees to soil, waste or drain stack.

F. Connections to stack and sewers shall be arranged so that operation of any fixture will not cause fluctuation of water level in traps of other fixtures.

G. All thread joints shall be made up with Teflon-bearing pipe joint compound applied to male thread only. Threads exposed after joints are made up shall be painted with red lead to prevent rust. Teflon tape may be used at Contractor’s option.

H. Junctions of screwed pipe to bell and spigot cast iron shall be made with ring or half coupling screwed to end of galvanized pipe to form spigot end.

I. Junctions in all drainage lines shall be made with “Y” branches or 1/8 bends, unless closeness of connection prevents it, in which case, where direction of flow is from horizontal to vertical, sanitary tees may be used upon the approval of the Engineer’s superintendent.

J. Do not install pvc piping in air-handling ceiling spaces, unless wrapped with an appropriate insulation, Per Division 22 Section “Mechanical Insulation”.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Division 22 Section, “Piping Specialties.”

3.5 INSTALLATION OF SUPPORTS, ANCHORS & SEALS

A. Install supports, anchors, and seals in accordance with Division 22 Section, “Supports, Anchors & Seals.”

3.6 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts:
   1. Install in above-ground piping and below grade building drain/waste piping as indicated and as required by The International Plumbing Code; and at each change in direction of piping greater than 45°; at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping; including the vertical component of the piping. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
   2. A cleanout shall be provided at no more than two feet above the base of each vertical storm, waste, or drain stack.
   3. Provide additional cleanouts as may be required for adequate rodding of the complete system.
   4. Cleanouts shall be flush with the surrounding wall or floor finish.
   5. Unless otherwise noted cleanouts shall not be installed in the center of corridors.
   6. Carpet markers shall be installed in all carpeted areas.

B. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.7 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer’s written instructions and in locations indicated.

B. Coordinate with building waste and drain piping as necessary to interface floor drains with drainage piping systems.

C. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

E. Position drains so that they are accessible and easy to maintain and coordinate the location with the architectural plans.

3.8 INSTALLATION OF BACKWATER VALVES

A. Install backwater valves in building waste and drain piping as indicated on the plans and as required by The International Plumbing code. For interior installations provide a cleanout cover flush with the floor, centered over the valve,

and of adequate size to remove the backwater valve cover for service.

3.9 INSTALLATION OF VENTS

A. All plumbing fixtures shall be vented to prevent siphoning of traps. Venting as shown on the plans is the minimum required. Vents and vent stacks shall be increased in size and/or number and relocated as required, to prevent trap siphoning and to comply with applicable codes, ordinances, statutes, regulations of all governmental bodies, without increase in contract price.

B. A vent stack shall be run parallel to each soil or waste stack to receive branch vents from fixtures and traps. Each vent stack shall originate from a soil or waste pipe at its base. Each soil or waste stack and each vent stack shall be carried through the roof. Where possible, soil, waste, or vent stacks shall be combined before passing through the roof so as to have as few roof openings as possible. Pipes running close to walls shall be offset away from such walls before passing through the roof to permit proper flashing. All vent pipes passing through the roof shall be sized as indicated on the drawings, and shall extend 12” above the roof.

C. All horizontal vent pipes shall grade to meet the requirements of all local and state codes.

D. Vent risers and branches shall connect to the soil and waste risers above the waste connection of the highest fixture.

E. Air admittance valve shall be used in lieu of venting only where shown on the plans and only where prior approval is granted by the local code enforcement authority.

3.10 EQUIPMENT CONNECTIONS

A. Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by The International Plumbing Code. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.11 PIPING TESTS

A. Test soil and waste piping system in accordance with the requirements of The International Plumbing Code.

END OF SECTION
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SECTION 223300 ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 1116; Domestic Water Piping.

1.2 SUMMARY

A. This Section includes the following electric water heaters:
   1. Storage type Domestic Water Heaters.

B. Compression tanks.

C. Water heater accessories.

1.3 SUBMITTALS

A. Product Data: Submit Manufacturer’s Technical Product Data, Specifications, and Installation Instructions for each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Submit shop drawings showing piping connection configurations, power diagrams, and signal and control wiring.

C. Wiring Diagrams: Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for water heaters. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Certificates of Shop Inspections and Data Reports: For each type of commercial water heater required to have an ASME label, signed by product manufacturer.

E. Source quality-control test reports.
   1. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
   2. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
   3. Prepare test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: Submit maintenance data and parts lists for each water heater. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing the contents.

H. Record Drawings: At project closeout, submit record drawings of installed water heater systems, show the exact location and piping configuration in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of water heaters 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 on projects with water heaters similar to that required for this project.

C. Source Limitations: Obtain each type of water heater through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

G. ASME Compliance:
   1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

H. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with the actual equipment provided, and the Architectural and Structural Plans.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:
   1. Structural failures including storage tank and supports.
   2. Faulty operation of controls.
   3. Deterioration of metals, metal finishes, and other materials beyond normal use.

C. Warranty Period(s): From date of Substantial Completion:
   1. Electric Water Heaters:
      a. Electric heating coil: Five years.
      b. Controls and Other Components: One year.

   2. Compression Tanks: One year.

PART 2 - PRODUCTS

2.1 STORAGE TYPE ELECTRIC HEATERS

A. Commercial, dual element, dual thermostat, Electric Water Heaters: Comply with UL 174 and ASHRAE/IESNA 90.1.
   1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
      a. AO Smith.
      b. Bradfford White.
      c. Rheem.

   2. Description: Dual elements with dual thermostats, diffuser dip tube for tank cleaning, CFC foam insulation, anode rod and a glass coated tank.
   3. Construction:
      a. Glass lined tank with two anode rods with and ASME rated T&P relief valve and a maximum working pressure of 150 psi.
      b. Incoloy stainless steel lower element.
      c. Connections shall be ¾” threaded connections.

2.2 COMPRESSION TANKS

A. 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.
   1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
      a. AMTROL Inc.
      b. Armstrong Pumps, Inc.
      c. Taco, Inc.
      d. Watts Regulator Co.

   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 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: Refer to drawings.

2.3 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
   1. Water Heaters: ANSI Z21.22/CSA 4.4.

B. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand/skid for floor mounting and stacking units, and capable of supporting water heater and water.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/ IESNA 90.1-2004.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters on 4” high concrete bases.

B. Install 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 combination temperature and pressure relief valves in water piping for 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.

D. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section, "Piping Specialties," for hose-end drain valves.

E. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section, "Meters and Gages," for thermometers.

F. Install pressure gage(s) on inlet and outlet piping of commercial, water heater piping. Refer to Division 22 Section, "Meters and Gages," for pressure gages.

G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

H. Fill water heaters with water.

I. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding."

D. Connect wiring according to Division 26 Section "Wiring and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect**,** field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
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SECTION 224200 PLUMBING EQUIPMENT AND FIXTURES

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 1116; Domestic Water Piping.

C. Section 22 1119; Piping Specialties.

D. Section 22 1316; Soil and Waste Piping Systems.

E. Division 26; Electrical connections to plumbing equipment and fixtures.

1.2 SUMMARY

A. Provide plumbing equipment, fixtures and trim, specified, shown on the plans and as required for a complete installation.

B. Provide scald protection devices as required for all fixtures required to have protection per the applicable codes.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of fixture or piece of equipment. Include faucets, carriers, mixing valves, seats and any accessories for each item.

B. Wiring Diagrams: Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for plumbing equipment and fixtures where required. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

C. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for fixtures and equipment. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout, submit record drawings of installed components showing locations in accordance with the requirements of Division 01. Plumbing equipment, fixtures and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers, installation instructions, start-up instructions, capacity and ratings, with selection points clearly indicated.

H. Shop Drawings: Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

I. Wiring Diagrams: Submit ladder-type wiring diagrams for all components, clearly indicating all required field electrical connections.

J. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment, fixture type and trim item, including instructions for care of finishes, "trouble shooting" maintenance. Include this data in maintenance manual.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of fixtures and equipment types, materials 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 on projects with work similar to that required for this project.

C. Source Limitations: Obtain fixtures and equipment through one source from a single manufacturer where at all possible.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section “Substitutions & Product Options.”

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

F. Comply with NSF 61, "Drinking Water System Components - Health Effects," for all components that will be in contact with potable water. Plumbing Fixture Standards: Comply with applicable portions of International Plumbing Code for installation of plumbing fixtures.

G. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bath tub units.

H. ANSI Standards: Comply with ANSI A171.1 standard pertaining to plumbing fixtures for handicapped.

I. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

J. Federal Standards: Comply with applicable Fed. Spec. WW-P-541/-Series sections pertaining to plumbing fixtures.

K. NAHB Label: Provide fiberglass bath tub units and shower stalls which have been tested and labeled by the National Association of Home Builders (NAHB) Research Foundation Inc.

L. UL Labels: Provide water coolers which have been listed and labeled by Underwriters Laboratories.

M. ARI Labels: Provide water coolers which are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute standards.

N. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

O. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

P. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) "National Fuel Gas Code", as applicable to installation of gas-fired water heaters.

Q. AGA and NSF Labels: Provide water heaters which have been listed and labeled by American Gas Association and National Sanitation Foundation.

R. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler and Pressure Vessel Code for construction, and stamp with ASME Code symbol:
   1. Commercial water heaters.
   2. Water softener pressure vessel.
   3. Water tanks.

S. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

T. Mineral Standards: Provide mineral products for water softeners, acceptable under state and local public health control regulations.

U. AWWA Compliance: Comply with applicable American Water Works Association standards pertaining to steel water tanks.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing equipment and fixtures individually wrapped in factory-fabricated containers.

B. Handle plumbing equipment and fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing equipment or fixtures; replace and return damaged units to equipment manufacturer.

1.6 COORDINATION

A. Coordinate the size and location of concrete bases with the actual equipment provided and the Architectural and Structural Plans.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Manufacturers, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:
1. Water Closets: Eljer, Kohler, American Standard, Toto, and Zurn.
2. Urinals: Eljer, Kohler, American Standard, Toto, and Zurn.
3. Lavatories: Eljer, Kohler, American Standard, Toto, and Zurn.
4. Lavatory Faucets: American Standard, Delta, Kohler, Moen, Toto and Zurn.
5. Sinks: Just, Advance Tabco, and Elkay.
6. Sink Faucets: Kohler, American Standard, Toto, Moen, and Zurn.
7. Garbage Disposals: In-Sink-Erator, Kitchenaid, Hobart, and Whirlpool.
8. Service Sinks: Stern-Williams, Kohler, American Standard, Fiat, and Zurn.
9. Water Coolers: Elkay, Oasis, and Halsey Taylor.
10. Floor Drains: Wade, Josam, Watts, Toto, and Zurn.
11. Cleanouts: Wade, Zurn, Josam, Jay R. Smith Mfg. Co., and Watts.
12. Wall Hydrants: Woodford, and Zurn.
13. Toilet Seats: Church, Bemis, Olsonite, Zurn and Toto.
14. Carriers: Wade, Zurn, Josam, Jay R. Smith Mfg. Co., and Watts
15. Trim: McGuire, Chicago Faucet, Dearborn Brass, Zurn, Engineered Brass Co. (EBC)

2.2 EQUIPMENT

A. Manufacturers, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

1. Water Heaters: Rheem, Lochinvar, Bradford-White, A.O. Smith, and State.
2. Backwater Valves: Wade, Jay R. Smith, Josam, and Zurn.

3. Back Flow Preventers: Refer to Division 22 Section, "Domestic Water Piping Systems."
4. Thermostatic Mixing Valves:
   a. Point of Use Tempering Valve: Apollo, Watts, and Leonard.

B. Fixture Carriers: Jay R. Smith Mfg. Co., Watts, Josam, and Zurn.

2.3 FIXTURES AND TRIM

A. Whenever possible all fixtures, trim, faucets, etc. specified as part of the project shall be of the same manufacturer's products.

B. Where manufacturer's numbers for a complete assembly are specified, the assembly shall be modified as required to meet the project requirements.

C. All fixtures shall be furnished complete as specified with brass piping, fittings, stops, trim and brackets. All exposed brass piping and fittings shall be chrome plated.
   1. Traps shall be 17 gauge chrome plated brass.
   2. Stops shall be chrome plated quarter-turn brass ball valves with chrome plated brass tubing and braided flexible stainless steel risers with a chrome–plated steel escutcheon.

D. Each fixture shall have an air gap connection or vacuum breaker on the domestic water connection as required by the local authority having jurisdiction and by all local and state health departments.

E. Water connection sizes are specified as a minimum size and shall be increased as required by the equipment or fixture manufacturer.

2.4 CARRIERS

A. Drinking fountains/water coolers, urinals, and water closets] shall be supported by a floor mounted carrier. Where urinals are mounted to a (minimum 6" thick) masonry wall the carrier may be omitted.
   1. Urinal carriers shall be equal to Zurn Model Z1217 selected to match the fixture. Verify the wall thickness and installation requirements prior to submitting and furnishing the carrier.

B. Carriers shall be selected for the particular fixture, piping arrangement and conditions at each location.

C. Special sinks, where wall mounted, shall be supported with a carrier designed for the fixture.

2.5 HANDICAPPED ACCESSIBLE WATER CLOSETS

A. For handicapped accessible water closets the flush handle shall be located on the wide side of the stall. Tank type water closets shall be furnished with the handle on the correct side of the tank. Flush valves shall be installed with the valve handle on the correct side.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing equipment and fixtures. Also examine floors and substrates, and conditions under which fixture or equipment work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures and equipment. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install plumbing equipment and fixtures of types indicated where shown and at specified heights; in accordance with manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing equipment and fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the International Plumbing Code pertaining to installation of plumbing equipment and fixtures.

B. Fasten plumbing equipment and fixtures securely to indicated supports or building structure; and insure that they are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

C. Fixtures intended to meet ADA requirements shall be installed at the recommended heights and with the required clearances.

D. Sinks and lavatories intended to meet ADA requirements shall be installed with offset tailpieces and insulated traps and supplies.

E. Fixtures that could present a scalding hazard to the building occupants shall be protected by a thermostatic mixing valve or other approved anti-scald device (i.e. all hand sinks supplied by a water heater stored at 140 deg. F).

F. Wall Hydrants shall be provided with the depth as required for proper installation due to the wall thickness, insulation thickness and structure. The contractor shall provide varying lengths of hydrants as required by the job site conditions.

3.3 OWNER FURNISHED FIXTURES AND/OR EQUIPMENT

A. Provide rough-ins and final connections to all owner furnished equipment including valves, piping, traps, vacuum breakers, pressure regulators, solenoid valves, etc. Required for connection of the fixture or equipment for a complete installation.

B. Install all faucets, drains, tailpieces, overflows, etc. furnished with owner provided fixtures and equipment for a complete installation.

C. All visible exposed piping and fittings for owner furnished fixtures and equipment shall be chrome plated brass. Exposed piping supports and braces shall be chrome plated.

D. All service lines to owner furnished fixtures and equipment shall be appropriately valved, capped, plugged and protected until connections are made.

3.4 CLEAN AND PROTECT

A. Clean plumbing equipment and fixtures of dirt and debris upon completion of installation.

B. Protect installed equipment and fixtures from damage during the remainder of the construction period.

3.5 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing equipment and fixtures and after units are water pressurized when required, test units to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove and replace with new unit. Feasibility and match to be judged by Architect. Remove damaged, cracked, or dented units and replace with new units.

3.6 EXTRA STOCK

A. Furnish special wrenches and other devices necessary for servicing plumbing equipment, fixtures, and trim to Owner with receipt. Furnish one device for every 10 units.

END OF SECTION
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SECTION 23 0500 COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other Division 23 sections.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.3 CODE REQUIREMENTS, FEES, AND PERMITS

A. Provide work in accordance with applicable codes, rules, ordinances, industry standards, utility company regulations, and regulations of local, state and federal governments and other authorities having lawful jurisdiction.

B. Unless otherwise noted, conform to latest editions and supplements of following codes, standards or recommended practices as adopted by the authority having jurisdiction:

1. Arkansas Mechanical Code
2. Arkansas Plumbing Code
3. Arkansas Fuel Gas Code
4. Arkansas Fire Prevention Code
5. Arkansas Energy Code
6. ASA - American Standards Association
7. ASME - American Society of Mechanical Engineers
8. ASTM - American Society of Testing Materials

9. NBS - National Bureau of Standards
10. NEMA - National Electrical Manufacturer's Association
11. NFPA - National Fire Protection Association
12. UL - Underwriters' Laboratories, Inc.
13. NSF - National Sanitation Foundation
14. Occupational Safety and Health Act of 1970
15. Life Safety Code, N.F.P.A. No. 101
16. N.F.P.A. 17/17A, 72, 72B, 54 and 96.

C. In case of differences between building codes, regulations, laws, local ordinances, industry standards, and utility company regulations, and the Contract Documents, the most stringent governs. Promptly notify Architect in writing of any such difference.

D. Obtain required permits in connection with this work and pay fees in connection therewith. Coordinate with the serving utility companies for the connections to utilities and pay charges for same, including inspection fees and meters if and when required.

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and within chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated enclosures.

1.5 PRODUCT SUBSTITUTION PROCEDURES

A. Manufacturers’ of other products than those listed may be considered. Submit substitution request in compliance with Section 01 2500 “Substitutions &

Product Options." All Divisions 22 and 23 substitution requests shall be submitted at least five working days prior to bid. Requests for substituion received by Engineer later than 5 days prior to bid opening may be rejected without review.

1.6 SUBMITTALS

A. The format and quantity of the submittals shall comply with the requirements of Division 01 General requirements and other Divisions 22 and 23 Sections.

B. Refer to the individual sections of Divisions 22 and 23 for additional and/or specific requirements.

C. Arrange product data in sets/electronic files with sections corresponding to and in the same order as Division 22 and 23 sections.

D. Provide an index of the sections at the front of the submittal listing the section number and items included in each section.

E. Provide cover sheet for each section, listing each type of material or equipment, designation and model number if any, and the name of the supplier.

F. Clearly indicate sizes, capacities, brand names, motor HP, accessories, options, materials, gages, dimensions, and other pertinent information. Pertinent information shall include items scheduled on the drawings as a minimum. Clearly indicate designations corresponding to drawings and schedules.

G. Provide performance charts and curves, installation instructions, and complete wiring diagrams.

H. Submittals failing to meet specified requirements will be returned without review or approval.

1.7 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 Section Project Management and Coordination, to a scale of 1/4"=1'0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major mechanical systems, equipment, and materials. Include the following:

a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
b. Exterior wall and foundation penetrations.
c. Fire-rated wall and floor penetrations.
d. Equipment connections and support details.
e. Sizes and location of required concrete pads and bases.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communications systems components, sprinklers, and other ceiling-mounted devices.

B. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including, but not necessarily limited to, the following:

1. Equipment Room Layouts: Specific equipment installations, including, but not limited to the following:

a. Furnaces.
b. Water Heaters.

1.8 PLANS

A. Plans show general arrangement of fixtures and equipment systems. Follow closely as actual building construction and work of other trades will permit.

B. Consider architectural and structural plans part of this work insofar as these plans furnish information relating to design and construction of building. These plans take precedence over the Mechanical Plans.

C. Due to the small scale of the Mechanical Plans, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories required to meet the conditions.

D. Record difference between mechanical work as installed and as shown in Contract Documents on a set of Record Documents. Return these prints to Architect at completion of project.

E. Do not scale mechanical drawings for dimensions. Accurately lay out work from dimensions indicated on structural and architectural drawings, and as verified in the field.

1.9 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work.

B. No subsequent compensation will be considered for any consequence related to failure to determine site conditions or nature of existing or new construction.

C. Locations and elevations of the various utilities and services included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work.

1.10 CONCRETE BASES

A. Coordinate the size and location of concrete bases with actual equipment provided and the Architectural and Structural Plans.

B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes of the Project.

1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section, “Cast-in-Place Concrete.”

1.11 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Certify that each welder has passed ASW qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at the expense of the Contractor. No additional money will be paid due to lack of coordination between the trades.

1.12 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Store products in either environmentally controlled spaces or supply sufficient electric heat internally to prohibit degradation from condensation.

1.13 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01 Section Execution and Closeout Procedures. In addition to the requirements specified in Division 01, indicate installed conditions for:

1. Major mechanical systems, size and location, for both exterior and interior; and locations of control devices.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 01 Section Execution and Closeout Procedures to record the locations of underground installations.

1.14 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01 Section Execution and Closeout Procedures. In addition to the requirements specified in Division 01, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.15 SYSTEM DEMONSTRATION AND OWNER'S INSTRUCTIONS

A. Demonstrate to the satisfaction of Owner's representative that mechanical systems and components are operating properly.

B. Utilizing Operation and Maintenance Manual, provide Owner's representative(s) instruction in the operation and maintenance of systems.

C. Provide minimum of 8 hours formal instruction balanced as required between classroom type instruction and "hands-on" instruction for each of the following:

1. Plumbing Systems and Equipment.
2. Mechanical Systems and Equipment.

D. Provide additional instruction where necessary to fully prepare Owner to operate and maintain systems and components.

E. Refer to individual Division 26 sections for additional requirements.

F. Demonstration and instruction to begin after Substantial Completion and before final payment.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 SLEEVES

A. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.

B. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

C. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe with plain ends and an integral water stop, unless otherwise indicated.

D. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.5 MECHANICAL SLEEVE SEALS

A. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. Unit shall be equal to a unit manufactured by Thunderline.

B. Fire Protection Mechanical Sleeve Seals: 3-hour fire rated modular mechanical type, consisting of interlocking fire-resistant silicone rubber links shaped to continuously fill the annular space between the pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when bolts are tightened, providing watertight and fire resistant seal. Units to be submitted for approval before installation.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

1. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide solid, non-hinged cast brass or sheet brass escutcheons.
2. Pipe Escutcheons for Dry Areas: Provide steel solid, non-hinged escutcheons with a set screw.

B. One-Piece, Brass, Deep-Pattern Type: Piping with fitting or sleeve protruding from wall.

C. One-Piece, Cast-Brass Type: With a set screw: Polished Chrome-plated (finished spaces); Rough brass (unfinished service spaces).

D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Sections for cutting and patching requirements and Division 02 Sections for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping that shall be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping that shall be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts that shall be removed: Remove portion of ducts indicated to be removed and seal remaining ducts airtight with same or compatible ductwork material.
4. Ducts that shall be abandoned in place: Cap or seal ducts airtight with same or compatible ductwork material.
5. Equipment that shall be removed: Disconnect and cap services and remove equipment.
6. Equipment that shall be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment that shall be removed and salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Sections for penetration firestopping materials information.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

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

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

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

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

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections for interior painting and exterior painting information.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Sections for metal fabrication information for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pumps and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION
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SECTION 23 0513 COMMON MOTOR REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED WORK

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 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. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specification sections.

C. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

1.3 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.4 REFERENCES

A. NEMA Standards MG 1: Motors and Generators.

B. Comply with National Electrical Code (NEC) (NFPA 70).

C. IEEE Standard 112: Tests for Motor Efficiency.

1.5 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.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 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.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. 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 (Not Applicable)

END OF SECTION
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SECTION 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 23 0700; HVAC Insulation.

C. Section 23 2300; Refrigerant Piping.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Performance Requirements

1. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
2. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of support. Include fabrication and installation details for each support.

B. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

C. Welding Certificates.

D. Source quality-control reports.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with support systems work similar to that required for this project.

B. Source Limitations: Obtain each type of support equipment through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

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

E. Pipe Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. 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.

B. 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.

2.2 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.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum 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.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: 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: 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.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 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

3.1 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-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 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 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.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. 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.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. 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.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. 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.

L. 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 4 and 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 4 and 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 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 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.

3.4 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.

3.5 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Cleaning and Touchup painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal as specified in Division 09 Painting sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 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 and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel 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 noninsulated 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. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. 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.
7. 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.
8. 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.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

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 Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. 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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. 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 powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION
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SECTION 230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

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. Warning tags.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, installation instructions and dimensioned drawings for each type of identification.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of system products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Source Limitations: Obtain each type of identification product through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitution & Product Options."

1.5 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

2.1 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: White.
3. Background Color: Black.
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,

2.2 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: White.

C. Background Color: Red.

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.

2.3 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.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
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

3.1 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.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. 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 penetrations through walls, floors, ceilings, and inaccessible enclosures.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Near major equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
5. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

2. Natural Gas Piping:

a. Background Color: Yellow
b. Letter Color: Black

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION
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SECTION 230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED WORK

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. Balancing of Air Systems:

1. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

G. Operation and Maintenance Manual Data: Submit a copy of the final approved Test & Balance report in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - Not Applicable

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Airetech Corporation – Little Rock, AR (501) 280-0404.
2. Powers of Arkansas – North Little Rock, AR (501) 374-5420.
3. Harrison Energy Partners – Little Rock, AR (501 661-0621.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Sections and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"; ASHRAE 111; NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP)] units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23 Sections.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering and leaving air temperatures.

C. Record compressor data.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.

8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for supply-air, static-pressure controller.
    g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Terminal units.
4. Balancing stations.
5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.

c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Cooling-coil static-pressure differential in inches wg.
g. Heating-coil static-pressure differential in inches wg.
h. Outdoor airflow in cfm.
i. Return airflow in cfm.
j. Outdoor-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..

h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.

f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following report data:

1. System and air-handling-unit number.
2. Location and zone.
3. Traverse air temperature in deg F.
4. Duct static pressure in inches wg.
5. Duct size in inches.
6. Duct area in sq. ft..
7. Indicated air flow rate in cfm.
8. Indicated velocity in fpm.
9. Actual air flow rate in cfm.
10. Actual average velocity in fpm.
11. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

   a. Measure airflow of at least 10] percent of air outlets.
   b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   c. Verify that balancing devices are marked with final balance position.
   d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect/Engineer].
3. Architect/Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.

2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION
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SECTION 230700 HVAC INSULATION

PART 1 - GENERAL

1.1 SCOPE

A. Piping System Insulation: Condensate drain piping systems in unconditioned spaces and Refrigerant piping systems.

B. Ductwork System Insulation: Dual temperature ductwork, andAir plenums and equipment housings.

1.2 RELATED WORK

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

B. Section 22 0700; Mechanical Insulation.

C. Section 23 3000; Air Distribution.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of insulation products of types, materials 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 on projects with insulation systems similar to that required for this project.

C. Source Limitations: Obtain each type of insulation through one source from a single manufacturer.

D. Product Options: Drawings and specifications indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of insulation. Include the manufacturer's product number, thickness, thermal conductivity, jackets (both factory and field applied, if any) and furnished accessories for each system requiring insulation.

B. Certifications: Submit manufacturers' certifications to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

C. Shop Drawings: Submit shop drawings for insulation installations including:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties, equipment connections, and access panels.
4. Detail application of field-applied jackets.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

B. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

C. Protect insulation against dirt, water, chemical or mechanical damage. Do not install damaged insulation.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Grade 1, Type I for tubular materials and Type II for sheet materials. Polyolefin is not an approved substitution and shall not be utilized.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

F. Flexible Elastomeric Exterior Sheet Insulation: Flexible expanded closed cell structure with a smooth skin on the interior side and a UV and damage resistant 12 mil laminated membrane on the exterior side. The insulation shall comply with ASTM C 534 for Grade 1, Type II sheet material. The puncture resistant embossed surface and seal tape shall provide a weatherproof seal that doesn't require painting. A 10 year membrane warranty shall be provided by the manufacturer.

1. Manufacturer, subject to compliance with the requirements, shall be the following or an Engineer approved equivalent:

a. Armacell LLC; AP Armatuff.

G. Fiberglass Wrap Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Owens Corning; All-Service Duct Wrap.

H. Rigid Fiberglass Insulation Board: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equal:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Owens Corning; Fiberglas 700 Series.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000 Pipe Insulation.
    c. 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 541, Class I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Flexible Elastomeric Pipe Insulation: Flexible expanded closed cell structure with a smooth skin on both sides per ASTM C534.

1. Thermal Conductivity: 0.25 BTU·in/h· ft^2 ·°F at 75°F and 90°F per ASTM C177 or C518.
2. Water vapor permeability: 0.05 Perm·in per ASTM E96 Procedure A.
3. Composite Surface Burning Characteristics: Flame spread of 25 and a developed smoke rating of 50 per ASTM E84.
4. Water Absorption: 0.2% by volume per ASTM C209.
5. Do <u>not</u> use for any systems with operating temperatures above 140° F.
6. Polyolefin shall not be considered an equal and is not allowed for any piping system.
7. Adhesive: Solvent based contact adhesive as recommended by the manufacturer.

K. PVC Premolded Piping, Fitting and Valve Covers:

1. Fabricated from one piece polyvinyl chloride plastic (PVC).
2. Piping covers shall have a minimum thickness of 20 mils.
3. Fitting and valve covers shall have a minimum thickness of 30 mils.

L. Aluminum Premolded Piping, Fitting and Valve Covers:

1. Constructed of 0.016” (minimum) thick aluminum alloy conforming to ASTM B209.
2. Fitting and valve covers shall be formed to fit from the manufacturer.
3. Lined with a 3 mil thick moisture retarder, laminated with heat and pressure.
4. Finish shall be a smooth bare mill finish.

2.2 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 Adhesive: Comply with ASTM E 84.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with ASTM C 916, Type I.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Carlisle HVAC Products;
b. Childers Products, Division of ITW; CP-82.
c. Foster Products Corporation, H. B. Fuller Company; 85-20.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive, and FSK and PVC Jacket Adhesive: Comply with ASTM C 916 for bonding insulation jacket lap seams and joints.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

    a. Dow Chemical Company (The); 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; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-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 and outdoor use on below ambient services.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

    a. Childers Products, Division of ITW; CP-35.
    b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    c. Marathon Industries, Inc.; 590.
    d. Mon-Eco Industries, Inc.; 55-40.

2. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.

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: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Childers Products, Division of ITW; 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, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 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. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC 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.

5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

d. Factory-Fabricated Fitting Covers:

(1) Same material, finish, and thickness as jacket.
(2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
(3) Tee covers.
(4) Flange and union covers.
(5) End caps.
(6) Beveled collars.
(7) Valve covers.
(8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
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/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.

3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:\

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. 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 closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

    a. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

        (1) AGM Industries, Inc.; CWP-1.
        (2) GEMCO; CD.
        (3) Midwest Fasteners, Inc.; CD.
        (4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

        (1) AGM Industries, Inc.; CWP-1.
        (2) GEMCO; Cupped Head Weld Pin.
        (3) Midwest Fasteners, Inc.; Cupped Head.
        (4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

(1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
(2) GEMCO; Perforated Base.
(3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

(1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
(2) GEMCO; Press and Peel.
(3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

(1) AGM Industries, Inc.; RC-150.
(2) GEMCO; R-150.
(3) Midwest Fasteners, Inc.; WA-150.
(4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with the requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment 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.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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 on center.

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 inches on center.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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 on the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

Q. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.4 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 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.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 DUCTWORK SYSTEM INSULATION

A. Refer to drawings and Division 23 Section, “Air Distribution,” for extent of internally lined ductwork insulation and the extent of the installation of duct wrap.

3.6 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. 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 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.
4. 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.

C. Provide metal aluminum, jackets and covers for all insulated piping exposed to the outdoors. Install metal jackets with 2-inch overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with aluminum draw bands 12 inches on center and at butt joints. Screw fasteners not permitted. Provide factory aluminum covers for all fittings. PVC fitting covers not permitted.

D. Provide a PVC jacket on all insulated pipe below 9’-0” above the finish floor where exposed in occupied spaces.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

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.
3. Install fitted PVC cover.

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.
5. Install fitted PVC cover.

3.8 MINERAL-FIBER INSULATION INSTALLATION

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 on center.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but 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 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.

C. 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.

D. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches on center.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches on center each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch on center. Install vapor barrier

consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches on center.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.

E. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches on center.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches on center each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch on center. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. 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 on center and at end joints.

3.10 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Exterior Insulation:

1. Rectangular supply, return or exhaust located in a nonconditioned, ventilated space (i.e. a ventilated attic).
2. Round supply or return ducts.
3. Exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.
7. Double-wall insulated ductwork.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, supply-air, return-air, outdoor-air, and exhaust-air duct and plenum insulation shall be the following:

1. Rectangular Duct:

a. Mineral-Fiber Blanket: 2 inches thick and 1-lb/cu. ft. nominal density.
b. Duct Liner complying with Division 23 Section “Air Distribution.”

2. Round Duct:

a. Mineral-Fiber Blanket: 2 inches thick and 1-lb/cu. ft. nominal density.

B. Exposed supply-air, return-air, outdoor-air, and exhaust-air duct and plenum insulation shall be the following:

1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

3.13 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.

3.14 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
b. Flexible Elastomeric: 1/2 inch thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. Liquid lines on units 5 tons and smaller do not require insulation.
2. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: ¾ inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3. Provide a PVC jacket on all insulated pipe below 9’-0” above the finish floor where exposed in occupied spaces.

3.15 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. Liquid lines on units 5 tons and smaller do not require insulation.
2. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: ¾ inches thick.

b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3. All exterior insulated piping shall have a metal jacket or have two coats of the manufacturer's recommended protective coating.

3.16 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. If more than one material is listed, selection from materials listed is Contractor's option

C. Pipe, pipe fittings / elbows:

1. PVC: 20 mils thick.

3.17 OUTDOOR, 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. All Exposed Exterior Piping:

1. Aluminum, Smooth: 0.016 inch thick.

3.18 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

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SECTION 232300 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 23 0700; HVAC Insulation.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of valve or refrigerant piping specialty. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Filter dryers.

B. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

C. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for refrigerant valves and piping specialties. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of ? system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

G. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

H. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

C. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.

6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

1. Atofina Chiemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

D. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

E. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Section, "Instrumentation and Control for HVAC," for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed below grade.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealers" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

W. Insulate refrigerant piping according to Division 23 Section “HVAC Insulation.”

3.4 PIPE JOINT CONSTRUCTION

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

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

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

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

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.

3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

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SECTION 233000 AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 0700; Mechanical Insulation.

C. Section 23 0593; Testing, Adjusting and Balancing for HVAC.

D. Section 23 0700; HVAC Insulation.

E. Section 23 3300; Air Duct Accessories.

F. Division 26; Electrical work, including electrical service to smoke dampers; not work of this section.

1.2 SUMMARY

A. Section includes air distribution, complete, including ductwork, duct liner, sealants and gaskets, hangers and supports.

B. Ductwork:

1. Low Pressure Ductwork: Defined as ductwork subjected to velocities of 1500 fpm or less, and operating pressure of 2" w.g. or less, positive or negative, for air-conditioning and heating supply air systems,fresh air supply systems, andmechanical exhaust systems,.

C. Outlets and Inlets: Ceiling air diffusers and grilles, wall registers and grilles, and louvers.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of manufactured product, factory-fabricated ductwork, air treatment equipment, air inlets and air outlets. Include the following:

1. Submit manufacturer's air treatment equipment specifications and installation instructions including, but not limited to, dimensions, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, and fire classification.
2. Submit manufacturer’s data on duct liner and adhesives.
3. Submit manufacturer's data on duct sealants and gaskets.
4. Submit manufacturer's data on outlets and inlets including the following:

    a. Schedule of outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
    b. Data sheet for each type of outlet and inlet, and accessory furnished, indicating construction, finish, and mounting details.
    c. Performance data for each type of outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings:

1. Submit shop drawings showing dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to the space enclosure. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

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

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

D. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

E. Source quality-control reports.

F. Field quality-control reports.

G. Test Reports: Submit leak test report for each duct system tested, including each hood exhaust system.

H. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

I. Record Drawings: At project closeout, submit record drawings of installed duct systems, show exact location of duct and air treatment equipment, air inlets and air outlets in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of air distribution products of types, materials 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 on projects with ductwork systems similar to that required for this project.

C. Source Limitations: Obtain each type of ductwork accessory or equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section “Substitutions & Product Options.”

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

G. Standards:

1. Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) low pressure duct construction standards.
2. Comply with applicable portions of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to duct construction.
3. American Standards: ASTM C 518 2004.

H. UL Compliance:

1. Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers."

I. NFPA Compliance:

1. Comply with ANSI/NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.5 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Deliver outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location

to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

C. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping. Store outlets and inlets in original cartons and protect from weather and construction work traffic.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions.

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DUCTWORK MATERIALS

A. General:

1. Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements, including proper connection of ductwork and equipment.
2. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

C. Except as otherwise indicated, fabricate ductwork from lockforming quality galvanized sheet steel complying with ASTM A 653, G90 zinc coating; mill phosphatized or “paint grip” finish for exposed locations.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum or stainless steel ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 FLEXIBLE DUCTS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Novaflex.
4. Buckley.

B. Insulated, Flexible Duct: UL 181, Class 1 air duct constructed in compliance with NFPA 90A with multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1-inch wg negative.
2. Maximum Air Velocity: 4,000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: R-5.0 at a mean temperature of 75 deg. F.

C. Flexible Duct Connectors:

1. Clamps:

a. Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." Liner shall have an anti-microbial agent to not support microbial growth as tested in accordance with ASTM G 21 and G 22. Fire ratings shall not exceed 25 for flame spread and 50 for smoke developed when tested according to ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials."

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. CertainTeed Corporation.
b. Johns Manville.

c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Thicknesses:

a. 1" thick 3 pound per cubic foot density insulation.
b. 2” thick 6 pound per cubic foot density insulation.

4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers: Suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Non-hardening, non-migrating mastic, liquid neoprene based cement or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork or for cementing fitting components and longitudinal seams in ductwork. The surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Foil Tape: Pressure sensitive tape with foil backing, non-hardening, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

C. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

D. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone or elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.7 HANGERS AND SUPPORTS

A. Ductwork Support Materials:

1. For concealed galvanized ductwork, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles.
2. For all exposed galvanized duct that shall be painted, provide matching galvanized steel support materials.
3. For exposed stainless steel ductwork, provide matching stainless steel support materials.
4. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.
5. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
6. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
7. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
8. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 DUCTWORK FABRICATION

A. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure and leakage classifications:

1. Supply Ducts: Leakage class: 3; refer to the “Duct Schedule” article for the duct pressure classification.

2. Return, Exhaust, and Low Pressure Supply Ducts: Leakage class: 24; refer to the “Duct Schedule” article for the duct pressure classification.

B. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

C. Shop fabricate ductwork of gages and reinforcement complying with SMACNA standards latest edition, or shop fabricate ductwork of gages and reinforcement complying with ASHRAE Handbook and Product Directory, 1979 Equipment Volume, Chapter 1 "Duct Construction.”

D. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings.

E. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

F. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.

2.9 GRAVITY VENTILATORS

A. General: Except as otherwise indicated, provide standard prefabricated gravity ventilator units of type and size indicated, modified as necessary to comply with requirements and as required for complete installation.

B. Hooded Gravity Ventilators:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Aerovent, Inc.
b. Greenheck Fan Corporation
c. Loren Cook Co.

2. Provide gravity ventilators, hooded type, curb mounted, of size, type and capacity as scheduled.

a. Type: Stationary, natural draft type. Provide weatherproof housings to match power ventilators in material and finish. Provide square or rectangular base to suit roof curb.

b. Bird Screens: Provide removable bird screens, 1/2" mesh, 16 gage aluminum or galvanized steel wire.

3. Bird Screen: Provide removable bird screens, 1/2" mesh, 16 ga. aluminum or galvanized steel wire.

C. Prefabricated Roof Curbs:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

   a. Custom Curb, Inc.
   b. Pate Co.

2. General: Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with requirements.
3. Fabricate structural framing for units of structural quality sheet steel (ASTM A 1011, Grade 40), formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation and deck construction. Include 45° cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units. Fabricate units from zinc-coated steel, ASTM A 653, Grade C, designation G90 hot-dip coating, mill phosphatized. Clean and paint with rust-inhibitive metal primer paint, of type recommended by manufacturer, 2.0 mils dry film thickness.
4. Sloping Roof Decks: For deck slopes of one inch per foot or more, fabricate support units for form level top edge. Where slope is less than one inch per foot, provide tapered wood nailers (treated wood) at top of support units to form level top edge.
5. Gage and Height: Fabricate units of metal gage and to height above roof surface as indicated. Where gage or height are not indicated, fabricate units of 14 gage metal and height of 14 inches.
6. Provide treated wood nailer, not less than 1-5/8" thick and of width indicated, but not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit.
7. Provide lumber pressure treated with water-borne preservatives for "above ground" use, complying with AWPB U1.
8. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-lb. density and 1-1/2" minimum thickness, except as otherwise indicated.
9. Provide support liners where shown, formed of 22 gage galvanized sheet metal, mill phosphatized, flanged at lower edges. Extend support liners through deck construction to coordinate with ductwork below as indicated.

10. Metal Deck Reinforcement: Where indicated as integral part of support units, provide channel-shaped metal deck closure strips to reinforce opening through metal decking. Fabricate strips from 14 gage metal to match metal and finish of curb units, except as otherwise indicated.

2.10 OUTLETS AND INLETS

A. General

1. Except as otherwise indicated, provide manufacturer's standard outlets and inlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated and as required for complete installation.
2. Performance: Provide outlets and inlets that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
3. Ceiling Compatibility: Provide diffusers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
4. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
5. Types: Provide outlets and inlets of type, capacity, and with accessories and finishes as listed on schedules. The following requirements shall apply to nomenclature indicated on schedule.
6. Manufactured by Titus, Tuttle and Bailey, Krueger or Price.

B. Diffuser and Grilles:

1. Faces:

   a. Square: Square housing, core of square concentric louvers, square or round duct connection.
   b. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
   c. Panel: Square or rectangular housing extended to form panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.
   d. Eggcrate: Square, or rectangular housing with ½-by-1/2-by-1-inch grid panel in frame.

2. Mountings:

    a. Stepped-Down: Diffuser housing below ceiling with perimeter flange and gasket to seal against ceiling construction.
    b. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
    c. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
    d. Snap-In: Diffuser housing sized to fit between ceiling concealed suspension runners, and snap into runners.

3. Patterns:

    a. Fixed: Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.
    b. Two Position: Manual two-position core with concentric rings or louvers, upper position for horizontal air flow, lower position for vertical air flow.
    c. Adjustable: Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.
    d. Four Way: Fixed louver face for four-direction air flow, directions indicated on drawings.

4. Dampers:

    a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser.
    b. Radial, sliding blade dampers not acceptable.
    c. 90A.

5. Accessories:

    a. Equalizing Deflectors: Adjustable parallel blades in frame for straightening air flow.
    b. Smudge Ring: Extension perimeter frame around diffuser, sized so induced air impinges on frame and not on ceiling.
    c. Plaster Ring: Perimeter ring designed to act as plaster stop and diffuser anchor.
    d. Extractor: Curved blades mounted on adjustable frame to produce air scooping action in duct at diffuser take-off.
    e. Blank-Off Baffles: Arc segments designed to fit into diffuser housing to divert air flow from impinging on obstruction.

f. Operating Keys: Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.

6. Finishes: Semi-gloss white enamel prime finish.

C. Wall Registers and Grilles:

1. Register and Grille Materials: Manufacturer's standard extruded aluminum frame and adjustable blades.
2. Register and Grille Faces: Horizontal blades, individually adjustable, at manufacturer's standard spacing.
3. Register and Grille Patterns: 2 sets of blades in face, rear set at 90° to face set.
4. Register and Grille Dampers: Adjustable opposed blade damper assembly, key operated from face of register.
5. Register and Grille Accessories:

a. Extractor: Curved blades mounted on adjustable frame to produce air scooping action in duct at register or grille take-off.
b. Plaster Frame: Perimeter frame designed to act as plaster stop and register or grille anchor.
c. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.

6. Register and Grille Finishes: Semi-gloss white enamel prime finish.

D. Louvers:

1. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

a. Ruskin Mfg. Co.
b. American Warming and Vent, Inc.
c. Vent Products.
d. Pottorff.
e. Greenheck Fan Corporation.

2. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated and as required for complete installation.Louvers shall be 4" deep unless otherwise indicated.
3. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

4. FEMA 361 approved stationary blade louver: Provide formed aluminum stationary horizontal chevron louver style as scheduled.
5. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate and that are specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
6. Materials: Construct of aluminum extrusions, ANSI/ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.
7. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
8. Drainable: Provide drain gutter in each blade and downspouts in jambs and mullions.
9. Finish: Kynar 500 finish, standard color as selected by Architect.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Sealant:

1. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.
2. Do not use two-part tape sealing system.
3. Do not use liquid sealant on exposed spiral duct.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts according to the higher class listed here or in the “Duct Schedule” article and according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Exhaust Ducts: Seal Class C.
3. Outdoor, Return-Air Ducts: Seal Class C.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection

D. Hangers Exposed to View: Threaded rod and angle, channel supports, or steel cable.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

C. Connect diffusers or light troffer boots to ducts directly or with maximum 5’-0” lengths of flexible duct clamped or strapped in place. Refer to the detail on the plans.

3.6 PAINTING

A. Paint interior of metal ducts and plenum surfaces that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Seal ducts according to the higher class listed here or in the “Duct Sealing” article.

C. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units.

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: B.

D. Return/Exhaust Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.

2. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Rectangular Supply Air Ducts: Fibrous glass, Type I, 1 inch thick unless otherwise indicated on the plans.
2. Rectangular Return Air Ducts: Fibrous glass, Type I, 1 inch thick unless otherwise indicated on the plans.
3. Supply Fan Plenums: Fibrous glass, Type II, 1 inch thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1500 fpm or Lower: 1.0 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

    b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated. Seal all seams.
    c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Conical Bell Mouth fitting or High Efficiency as detailed on the plans.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: Conical tap or 45-degree lateral as indicated on the plans.

3.10 DUCT LINER APPLICATION

A. Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner, with coated surface exposed to air stream and factory applied edge coating to prevent erosion of glass fibers, with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

3.11 INSPECTION

A. Examine areas and conditions under which air distribution work will be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.12 INSTALLATION OF AIR DISTRIBUTION WORK

A. Installation of Ductwork: Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight within specified leakage class and noiseless (no objectional noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance

and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and prevent buckling.

1. Seal all joints and seams for all HVAC duct systems. The use of "duct tape" is not permitted. Comply with duct manufacturer's recommendations. Seal ductwork using the following methods to achieve leakage limit requirements:

    a. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
    b. Joint and Seam Sealants: One-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.
    c. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
    d. Foil Tape: Pressure sensitive, 2 mil foil backing, 33 mil elastomeric modified butyl adhesive/sealant, rated up to 10 inch w.g. pressure class, seals on immediate contact, as manufactured by Hardcast or approved equal.

        1) Apply only to low pressure supply ductwork downstream of air terminal boxes and exhaust duct systems.

2. Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.
3. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
4. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for one-inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate

layout with suspended ceiling and lighting layouts and similar finished work.

5. Electrical Equipment Spaces: Do not run ductwork through electrical equipment spaces and enclosures.
6. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on four sides by at least 1-1/2".
7. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
8. Support ductwork in manner complying with applicable SMACNA duct standards, latest edition, hangers and supports section.
9. Balancing: Refer to Section 23 0593 for air distribution balancing of ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

B. Installation of Flexible Ducts: Flexible duct shall be used only for runouts to supply or return diffusers (not for exhaust) and only in lengths of 5’ or less.

C. Installation of Outlets and Inlets: Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

1. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of outlets and inlets with other work.
2. Locate ceiling air diffusers, registers, and grilles, as indicated on Reflected Ceiling Plans. Unless otherwise indicated, locate units in center of acoustical ceiling modules.

D. Balancing: Refer to Division 23 Section, “Testing, Adjusting, and Balancing for HVAC,” for balancing of outlets and inlets; not work of this section.

3.13 CLEANING AND PROTECTION

A. Ductwork:

1. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
2. Strip protective paper from stainless ductwork surfaces and repair finish wherever it has been damaged.

3. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

B. Field Quality Control:

1. Remake leaking joints as required and apply sealants to achieve specified leakage limits.
2. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing and as required for compliance with test requirements.
3. Conduct leakage tests in the presence of the Owner's representative. Give seven days advanced notice for testing.
4. Determine leakage from entire system or section of the system by relating leakage to the surface area of the test section.

3.14 EXTRA STOCK/SPARE PARTS

A. Furnish to Owner, with receipt, three operating keys for each type of outlet and inlet that require them.

END OF SECTION
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SECTION 233300 AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 23 3000; Air Distribution.

1.2 SUMMARY

A. Section Includes

1. Take-offs.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Remote damper operators.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of product specified. Include the following:

B. Submit manufacturer's specifications for each type of duct accessory, including dimensions, capacities, and materials of construction; and installation instructions.

C. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

D. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for accessory materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

H. Record Drawings: At project closeout, submit record drawings of installed specialties, show the exact location in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of ductwork accessory system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of accessory through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Submittals & Product Options."

E. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

G. Comply with AMCA 500-D testing for damper rating.

H. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 COORDINATION

A. Coordinate the size and location of concrete bases with actual equipment provided and structural and architectural plans.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 TAKE-OFFS

A. High-efficiency take-offs.

1. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

a. Buckley.
b. Flexmaster.

2. Supply air branch duct high efficiency fittings shall be a 45 degree entry take-off with a rectangular to round adapter and equipped with dampers having an operating handle and a locking device. Fittings shall have dampers with locking quadrant type operating handle, and shall clearly indicate damper position. Extension rods shall be installed such that the operating handle is visible and accessible thru the duct wrap insulation. Take-offs shall be heavy-duty galvanized steel with neoprene gasket and 26 gauge galvanized damper.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

a. American Warming and Ventilating; a division of Mestek, Inc.
b. Flexmaster U.S.A., Inc.
c. Nailor Industries Inc.
d. Ruskin Company.
e. Pottorff.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Molded synthetic.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft

1. Size: 1-inch diameter
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a ¾-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Flexmaster U.S.A., Inc.
4. Nailor Industries Inc.
5. Ruskin Company.
6. Young Regulator Company.
7. Pottorff.

B. Frames

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

C. Blades

1. Multiple blade with maximum blade width of 8 inches.
2. Opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.

D. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.4 FIRE DAMPERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Cesco Products; a division of Mestek, Inc.
2. Nailor Industries Inc.
3. Ruskin Company.

4. Pottorff.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Fire Rating:

1. 1-1/2 hours.
2. 3 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 FLANGE CONNECTORS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. SEMCO Incorporated.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.7 REMOTE DAMPER OPERATORS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 3/4 inches deep.

F. Wall-Box Cover-Plate Material: Steel.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular of same or greater gage as ductwork served.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Frames: Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

(1) Provide negative pressure relief type access door for positive pressure medium pressure supply ducts.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.9 FLEXIBLE CONNECTORS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

C. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.11 DUCT ACCESSORIES MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ANSI/ASTM A 653.

1. Galvanized Coating Designation: ANSI/ASTM A 653 G90.
2. Exposed-Surface Finish: Mill phosphatized or “Paint Grip” finish.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum or stainless steel ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

B. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts and in accordance with recognized industry practices to ensure that products serve intended function.

C. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

D. Turning Vanes: Install turning vanes in square or rectangular 90° elbows in supply, return, relief, outside air supply and exhaust air systems and elsewhere as indicated. Install acoustical turning vanes only in high velocity 90° elbows.

E. Access Doors:

1. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

a. Downstream from control dampers and equipment.
b. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from

dampers and inward operation for access doors installed downstream from dampers. Provide negative pressure relief type access door downstream, unless otherwise indicated, of fire dampers and combination fire/smoke dampers for high pressure supply trunk duct only.

c. Control devices requiring inspection.
d. Elsewhere as indicated.

2. Install access doors with swing against duct static pressure.
3. Access Door Sizes (Size and location of doors shall be adequate for inspection and maintenance of duct mounted equipment):

a. One-Hand or Inspection Access: 8 by 5 inches.
b. Two-Hand Access: 12 by 6 inches.
c. Head and Hand Access: 18 by 10 inches.
d. Head and Shoulders Access: 21 by 14 inches.
e. Body Access: 25 by 14 inches.
f. Body plus Ladder Access: 25 by 17 inches.

4. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

F. Installation of Ventilators: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.

1. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
2. Ductwork: Connect ducts to ventilators in accordance with manufacturer's installation instructions. Solder bottom joints and up 2" of side joints of duct under roof ventilator to retain any moisture entering ventilator.
3. Roof Curbs: Furnish roof curbs to roofing installer for installation.

G. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

H. Install steel volume dampers in steel ducts.

I. Set dampers to fully open position before testing, adjusting, and balancing.

J. Install test holes at fan inlets and outlets and elsewhere as indicated.

K. Install fire dampers according to UL listing.

L. Install flexible connectors to connect ducts to equipment.

M. Install duct test holes where required for testing and balancing purposes.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate installed duct accessories to demonstrate compliance with requirements
2. Operate dampers to verify full range of movement.
3. Inspect locations of access doors and verify that purpose of access door can be performed.
4. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
5. Inspect turning vanes for proper and secure installation.
6. Operate remote damper operators to verify full range of movement of operator and damper.
7. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leakproof performance.

END OF SECTION
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SECTION 233400 FANS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 22 0300; Electrical Requirements for Mechanical Equipment.

C. Section 23 0593; Testing, Adjusting and Balancing.

D. Section 23 3000; Air Distribution.

E. Electrical work required in conjunction with fans; Division 26.

1.2 SUMMARY

A. Types of equipment fans required for project include in-line centrifugal fan and ceiling ventilators.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, required clearances, method of field assembly, and installation instructions.

B. Submit equipment connection and support details. Equipment connection details to indicate all connections with sizes and types of duct and fittings to be used. Support details to include fabrication, materials, and methods of support intended. Include detail of vibration isolation.

C. Shop Drawings: Submit shop drawings for fans, showing unit dimension, required clearances, and construction details. Show interface and spatial relationship between ductwork, approximate structures and the work of other trades.

D. Wiring Diagrams: Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for fans. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate

between portions of wiring that are factory-installed and portions to be field-installed.

E. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

F. Source quality-control reports.

G. Field quality-control reports.

H. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for fans. Include this data, lubrication instructions, motor and drive replacement, spare parts lists, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

I. Record Drawings: At project closeout, submit record drawings of installed fan locations, show exact location and connection sizes in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of fans of types, materials 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 on projects with fan systems similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

F. AMCA Compliance: Provide fans bearing the Air Movement and Control Association, Inc. (AMCA) Certified Ratings Seal.

G. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. UL Compliance: Provide fan electrical components which have been listed and labeled by Underwriters Laboratories (UL).

I. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

J. ANSI/ABMA 9: Load Ratings and Fatigue Life for Ball Bearings.

K. ANSI/ABMA 11: Load Ratings and Fatigue Life for Roller Bearings.

L. ASHRAE: Test and rate fans in accordance with ASHRAE Standard 51 (AMCA Standard 210).

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver fans with factory-installed shipping skids and lifting lugs. Pack components in factory-fabricated protective containers.

B. Handle fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components. Replace and return damaged components to fan manufacturer.

C. Store fan in clean, dry place, and protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 FANS

A. Manufacturer, subject to compliance with the requirements, shall be one of the following or an Engineer approved equivalent:

1. Cook.
2. Greenheck.
3. Acme.
4. Twin City Blower.

B. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities, types, sizes, and characteristics.

C. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

1. Fan Shaft: Turned, ground, and polished steel, designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

D. Motors:

1. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.
2. Motor Sizes: Minimum sizes and characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.
3. Temperature Rating: 50°C maximum temperature rise at 40°C ambient for continuous duty at full load (Class A Insulation).
4. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.
5. Electronically Commutated Motor: Rated for continuous duty, furnished with:

    a. Internally mounted potentiometer speed controller.

6. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B; Design C where high starting torque requirements are anticipated.

    a. Enclosure Type: The following features are required:

        1) Open drip-proof motors where satisfactorily housed or remotely located during operation.
        2) Guarded drip-proof motors where exposed to contact by employees or building occupants.

    b. Overload Protection: Built-in, automatic reset, thermal overload protection.

2.2 CEILING VENTILATORS

A. Centrifugal Ceiling Exhausters: Provide centrifugal ceiling exhausters, designed for ceiling or wall mounting, of type, size and capacity as scheduled. Provide AMCA Certified Ratings Seal.

1. Type: Provide galvanized steel housing lined with acoustical insulation, adaptable for ceiling or wall installation. Provide centrifugal forward curved fan wheels mounted on motor shaft with fan shrouds, all removable for service. Provide integral backdraft damper fan discharge.
2. Grille: Provide powder-painted white aluminum grille with flange on intake with thumbscrew attachment to fan housing.
3. Motor: Provide permanent split-capacitor motor, permanently lubricated, with grounded cord and plug.

4. Electrical: Provide junction box for electrical connection on housing, and receptacle for motor plug-in. Accessories:

    a. Variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.
    b. Isolation: Rubber-in-shear vibration isolators.
    c. Transition fittings as indicated on drawings or schedules.

2.3 IN-LINE CENTRIFUGAL FANS

A. General: In-line, direct drive or belt-driven, centrifugal fans consist of housing, wheel, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.

B. Housing: The fan wheel housing and integral outlet duct shall be injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. The outlet duct shall have provision for an aluminum backdraft damper with continuous aluminum hinge rod. The inlet box shall be minimum 22 gauge galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. A field wiring compartment with disconnect receptacle shall be standard. To accommodate different mounting positions, an adjustable prepunched mounting bracket shall be provided.

C. Wheel: Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.

D. Accessories: The following accessories are required as indicated:

1. Speed Control: Variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.
2. Isolation: Rubber-in-shear vibration isolators.
3. Transition fittings as indicated on drawings or schedules.

PART 3 - EXECUTION

3.1 INSPECTIONS

A. Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FAN EQUIPMENT

A. Install fans where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.

B. Coordinate with other work, including ductwork, floor construction, roof, wall, ceiling, and electrical work as necessary to interface installation of air handling equipment with other work.

C. Vibration Isolation:

1. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and rubber-in-shear vibration isolators.

D. Ductwork: Refer to Division 23 Section, “Air Distribution“. Connect ducts to ventilators in accordance with manufacturer's installation instructions.

E. Identification: Install equipment identification complying with Division 23 Section, “Identification for HVAC Piping and Equipment.”

F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.3 ELECTRICAL CONNECTIONS

A. Ensure that fans are wired properly, with rotation in direction indicated and intended for proper performance. Provide positive electrical equipment and motor grounding.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of fans test equipment to demonstrate compliance with requirements. Field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected. Perform the following field tests and inspections and prepare the appropriate test reports:

1. Verify that shipping, blocking and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.

END OF SECTION
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PART 1 - GENERAL

1.1 RELATED WORK

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

B. Refer to other Division 23 sections for vent flues, refrigeration and gas piping, etc. required external to furnaces for installation.

C. Refer to Division 26 sections for the following; not work of this section.

1. Power supply wiring from power source to power connection on furnaces. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
2. Interlock wiring specified as factory-installed is work of this section.
3. Interlock wiring between furnaces and between furnaces and field-installed control devices.

D. Provide the following electrical work as work of this section complying with requirements of Division 26 sections:

1. Control wiring between field-installed controls indicating devices and furnace control panels.

E. Refer to other Division 23 sections for automatic temperature controls, not factory-installed, required in conjunction with furnaces; not work of this section.

1.2 SUMMARY

A. This Section includes furnaces and accessories complete with controls.

B. This Section includes furnaces, controls, direct-expansion cooling coils, air filters, and refrigeration components.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of furnace, coil, and condensing unit. Include rated capacities, weights, marked fan performance curves and furnished specialties and accessories for each furnace and condensing unit.

B. Shop Drawings: Submit shop drawings for furnaces, showing assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for furnaces. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

D. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

E. Welding Certificates.

F. Source quality-control reports.

G. Field quality-control reports.

H. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for each type of furnace, control, and accessory, including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

I. Record Drawings: At project closeout, submit record drawings of installed systems, show exact location and connections of ductwork, power and gas piping in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of furnaces of types, materials 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 on projects with furnaces similar to that required for this project.

C. Source Limitations: Obtain each type of furnace through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section “Submittals & Product Options.”

E. Welding Qualifications: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code. 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.

F. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

G. Electrical Compliance: Provide components that comply with NFPA 70 and that are listed and labeled by UL.

H. Listing and Labeling: Provide electrically operated fixtures specified in this section that are listed and labeled.

1. The terms "listed" and "labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 COORDINATION

A. Coordinate the size and location of concrete bases with actual equipment provided and the architectural and structural plans.

1.6 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to the following:

1. Heat exchanger failure.
2. Compressor failure.
3. Faulty operation of controls.
4. Deterioration of any component beyond the degradation of normal use.

B. Warranty Period:

1. Provide a one (1) year parts and labor warranty for the complete furnace, evaporator coil and condensing unit.
2. Provide a ten (10) year parts only warranty on the complete heat exchanger assembly.
3. Compressor: 5 years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle furnaces and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged furnace or components; replace with new.

B. Store furnaces and components in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading furnaces and moving them to final location.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with a protective covering for storage and identified with labels describing the contents.

1. Filters: Furnish one (1) set of each type of filter specified.
2. Fan Motor Drive Belts: Furnish one (1) set of belts for each belt-driven fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:

1. Carrier Corp.
2. Daikin
3. Lennox.
4. Trane Co.

2.2 FURNACES, GENERAL

A. Description: Factory assembled, piped, wired, and tested.

B. Configuration: Upflow.

C. Cabinet: Steel with foil-faced, glass-fiber, interior insulation. Lift-out panels expose burners and all other items requiring access for maintenance.

D. Finish of External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

E. Fan: Centrifugal, factory balanced, resilient mounted.

F. Fan Motors: Energy-efficient type as specified in Section 22 0300 "Electrical Requirements for Mechanical Equipment." Totally enclosed, with internal thermal protection and permanent lubrication.

G. Fan Motors: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

2.3 GAS-FIRED FURNACES, CONDENSING

A. Comply with ANSI Z21.47, "Gas-Fired Central Furnaces"; and NFPA 54, "National Fuel Gas Code."

1. AGA Approval: Bear label of American Gas Association.
2. Type of Gas: Natural.

B. Efficiency: 93 percent AFUE, minimum.

C. Heat Exchanger: Aluminized-steel welded construction with aluminum-finned, stainless-steel tube condensing coil.

D. Burner Controls: Solid state; control gas valve and ignition.

1. Gas Valve: 100 percent safety gas shutoff; 24-V modulating or 2-stage, combining pressure regulation and manual shutoff.
2. Ignition: Electronic pilot ignition, with electric spark igniter.

E. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ingnition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

F. Combustion Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevetns furnace ooperation if combustion-air inlet or flue outlet is blocked.

G. Automatic Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories. .

H. Accessories:

1. Combination Combustion-air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
2. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
b. PVC Plastic Fittings: Schedule 40, complying with ASTM D2466, socket type.
c. PVC Solvent Cement: ASTM D2564.

I. Capacities and Characteristics: Refer to equipment schedule on drawings.

2.4 CONTROLS

A. Furnace Controls: Include components required for satisfactory operation of furnaces and auxiliary equipment in all seasons.

B. Control Transformer: 24 VAC output, factory installed, and wired in furnace.

C. Thermostat: 24 VAC, solid-state, programmable, microprocessor-based wall mounting unit with automatic switching from heating to cooling, preferential rate control, multiple temperature presets selectable by day and time, and battery back-up protection of program settings against power failure.

D. Relays: As required to achieve specified operation.

E. Wire and Cable: Specified in Division 26.

2.5 AIR FILTERS

A. Filters: 1-inch- thick pleated fiberglass media with ASHRAE 52.2 MERV rating of 8 or higher in sheet metal rack/side access filter housing.

2.6 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1-2007, “Energy Standard for Buildings except Low-Rise Residential Buildings.”

B. Evaporator Coil: Conform to ANSI/AHRI 210/240, "Unitary Air Conditioning and Air Source Heat Pump Equipment." Mate and match size with furnace, remote condensing unit specified in Section 23 6300 "Condensing Units" with type, capacity, pressure-drop ratings, restricted distributor, or expansion valve. Include condensate drain pan with accessible drain outlet.

C. Evaporator Coil Enclosure: As required to suit furnace and cooling coil. Steel cabinet with access panel and flanges for integral mounting at or on furnace cabinet.

D. Refrigerant Piping: Comply with requirments in Division 23 section “Refrigerant Piping.”

E. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; with insulated suction line and flared fittings at evaporator end; no fitting at condenser end; length as required.

F. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically selaed scroll type.

    a. Crankcase heater.
    b. Vibration isolation mounts for compressor.
    c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    d. Compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
    e. Refrigerant Charge: R-410A..

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kity: Permits operation down to 0 deg F.

G. Capacities and Characteristics: Refer to equipment schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install furnaces and accessories according to manufacturer's written instructions.

B. Install and connect gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's published installation instructions.

1. Connect gas piping according to Division 22 Section, "Natural Gas Piping Systems."
2. Connect vents according to Division 23 Section, "Air Distribution."
3. Vents, Outside-Air Pipe Connections, and Drains: Where polyvinyl chloride (PVC) piping is used, install according to Division 22 Section, "Soil & Waste Piping Systems." Install vent terminal designed to protect against birds, insects, and dirt.
4. Connect condensate drain pans using copper tubing, ASTM B 88, Type K (ASTM B 88M, Type C) with streamline drainage fittings and soldered joints or PVC drainage piping. Extend to nearest equipment drain or floor drain. Construct vented, trap at connection to drain pan and install cleanouts at changes in direction. Terminate to suit local code requirements, except where stricter methods are indicated.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base where installation conditions require.

D. Controls: Install thermostats and humidistats at mounting height of 48 inches above floor.

E. Control Wiring: Install control wiring as specified in Division 26 Sections.

F. Connect ducts to furnace with flexible connector according to Division 23 Section, "Air Distribution."

G. Install ground-mounted, compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, an formwork are specified in Division 03 Section “Cast-in-Place Concrete.” Coordinate anchor installation with concrete base.

H. Identify furnaces, condensing units and connections according to Division 23 Section, "Mechanical Identification."

I. Test, adjust and balance furnaces in accordance with Division 23 Section, “Testing, Adjusting, and Balancing for HVAC.”

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Gas Piping: Conform to applicable requirements of Division 22 Section, "Natural Gas Piping Systems." Connect gas piping to furnace, full size of furnace gas train inlet, and provide union with sufficient clearance for burner removal and service.
3. Refrigerant Tubing: Conform to applicable requirements of Division 23 Section, "Refrigerant Piping." Connect refrigerant tubing to coils and condensing units.

B. Electrical: Conform to applicable requirements of Division 26 Sections.

1. Install electrical devices provided with furnace but not specified to be factory mounted.

C. Connect motors and components to wiring systems and to ground as indicated and instructed by manufacturer. 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.

3.3 ADJUSTING AND CLEANING

A. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

B. After completing system installation, inspect furnaces and associated components. Repair scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.4 START UP

A. Start-up Services: Provide start-up service in accordance with manufacturer's start-up instructions and in the presence of manufacturer's representative, as specified below.

1. Start each furnace and operate controls.
2. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
3. Test functions, operations, control sequences, and protective features. Adjust to ensure operation is as specified.

B. Correct deficiencies identified by tests and observations and retest until specified requirements are met.
C. Install new filters in each furnace within 14 days after Substantial Completion.

3.5 TRAINING OF OWNER'S PERSONNEL

A. Provide services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of furnaces. Schedule training with Owner; provide at least 7-day notice to Contractor and Architect of training date.

END OF SECTION
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SECTION 238126 SPLIT-SYSTEM AIR-CONDITIONERS

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. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Each combination shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210/240 and bear the ARI label.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Daikin AC, Inc.
   2. LG Air Conditioning
   3. Mitsubishi Cooling & Heating
   4. Sanyo Fisher (U.S.A.) Corp.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
   1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
   2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   1. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

E. Filters: Disposable, with ASHRAE 52.2 MERV rating of 6 or higher.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   1. Compressor Type: Scroll.
   2. Refrigerant: R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 0 deg F.

H. Mounting: Equipment mounting rail.

I. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.4 ACCESSORIES

A. Thermostat: Low voltage with sub-base to control compressor and evaporator fan with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Condensate Pump.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement and formwork are specified in Division 3 Section “Cast-in-Place Concrete.” Coordinate anchor installation with concrete base.

D. Install and connect refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238126

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SECTION 260500 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and other Sections of Division 26.

B. Section 22 0300; Electrical Requirements for Mechanical Equipment, for factory installed motors, controllers, accessories and connections.

C. Division 26; for materials and methods common to the remainder of Division 26 work including:
   1. Access to electrical installations.
   2. Excavation for electrical installations within the building boundaries and from building to utility connections.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this section to expand the requirements specified in Division 01.
   1. Code Requirements, Fees and Permits.
   2. Product Substitution Procedures.
   3. Submittals.
   4. Coordination drawings.
   5. Drawings.
   6. Local Conditions.
   7. Temporary Power.
   8. Cutting and patching.
   9. Rough-ins.
   10. Quality Assurance.
   11. Record documents.
   12. Operation and Maintenance Manuals.
   13. Electrical installations.
   14. System Demonstration and Owner’s Instruction.

1.3 CODE REQUIREMENTS, FEES, AND PERMITS

A. Provide work in accordance with applicable codes, rules, ordinances, industry standards, utility company regulations, and regulations of local, state and federal governments and other authorities having lawful jurisdiction.

B. Unless otherwise noted, conform to latest editions and supplements of following codes, standards or recommended practices as adopted by the authority having jurisdiction:
   1. National Electric Code
   2. International Building Code
   3. ASA - American Standards Association
   4. ASME - American Society of Mechanical Engineers
   5. ASTM - American Society of Testing Materials
   6. NBS - National Bureau of Standards
   7. NEMA - National Electrical Manufacturer's Association
   8. NFPA - National Fire Protection Association
   9. UL - Underwriters' Laboratories, Inc.
   10. NSF - National Sanitation Foundation
   11. occupational Safety and Health Act of 1970
   12. Life Safety Code, N.F.P.A. No. 101
   13. N.F.P.A. 17/17A, 72, 72B, 54 and 96.

C. In case of differences between building codes, regulations, laws, local ordinances, industry standards, and utility company regulations, and the Contract Documents, the most stringent governs. Promptly notify Architect in writing of any such difference.

D. Obtain the required permits in connection with this work and coordinate with the serving utility company for the installation of the electric service as shown on the plans.

1.4 PRODUCT SUBSTITUTION PROCEDURES

A. Manufacturers' of other products than those listed may be considered. Submit substitution request in compliance with Division 01 Section, "Substitution & Product Options." All Division 26 substitution requests shall be submitted at least five working days prior to bid. Requests for substituion received by Engineer later than 5 days prior to bid opening may be rejected without review.

1.5 SUBMITTALS

A. The format and quantity of the submittals shall comply with the requirements of Division 01 General requirements and other Division 26 Sections.

B. Refer to the individual sections of Division 26 for additional and/or specific requirements.

C. Arrange product data in sets/electronic files with sections corresponding to and in the same order as Division 22 and 23 sections.

D. Provide an index of the sections at the front of the submittal listing the section number and items included in each section.

E. Provide cover sheet for each section, listing each type of material or equipment, designation and model number if any, and the name of the supplier.

F. Clearly indicate sizes, capacities, brand names, motor HP, accessories, options, materials, gages, dimensions, and other pertinent information. Pertinent information shall include items scheduled on the drawings as a minimum. Clearly indicate designations corresponding to drawings and schedules.

G. Provide performance charts and curves, installation instructions, and complete wiring diagrams.

H. Submittals failing to meet specified requirements will be returned without review or approval.

1.6 PLANS

A. Plans show general arrangement of panels, circuits, lights and equipment systems. Follow closely as actual building construction and work of other trades will permit.

B. Consider architectural and structural plans part of this work insofar as these plans furnish information relating to design and construction of building. These plans take precedence over the Electrical Plans.

C. Due to the small scale of the Electrical Plans, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings and accessories required to meet the conditions.

D. Record difference between electrical work as installed and as shown in Contract Documents on a set of Record Documents. Return these prints to Architect at completion of project.

E. Do not scale electrical drawings for dimensions. Accurately lay out work from dimensions indicated on structural and architectural drawings, and as verified in the field.

1.7 LOCAL CONDITIONS

A. Visit site and determine existing local conditions affecting work.

B. No subsequent compensation will be considered for any consequence related to failure to determine site conditions or nature of existing or new construction..

C. Locations and elevations of the various utilities and services included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work.

1.8 CONCRETE BASES

A. Coordinate the size and location of concrete bases with actual equipment provided and the Architectural and Structural Plans.

B. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes of the project.
   1. Construct concrete bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section, "Cast-in-Place Concrete."

1.9 TEMPORARY ELECTRICAL UTILITIES

A. Comply with requirements of Division 01 for Construction Facilities and Temporary Controls.

B. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with all utility company requirements and recommendations. Arrange with the utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

C. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service overhead, unless otherwise indicated.

D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements.
   2. If the Owner's permanent lighting is used at anytime during construction, then at the end of construction (defined by Owner's Acceptance of "Substantial Completion") the contractor shall furnish all new lamps in all permanent light fixtures.
   3. Note: Contractor shall request and allow engineer to examine all cartons of the new lamps before the new lamps are installed at end of construction.

E. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install two telephone lines for each field office.
   1. Provide additional telephone lines in each field office for the following:
      a. Provide a dedicated telephone line for each facsimile machine.
      b. Provide a dedicated telephone line for each computer.

   2. At each telephone, post a list of important telephone numbers including police and fire departments, Contractor's home office, Architect's office, Owner's office, Principal subcontractor's field and home offices.
   3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

F. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail in each field office.

1.10 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Certify that each welder has passed ASW qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at the expense of the Contractor. No additional money will be paid due to lack of coordination between the trades.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Store products in either environmentally controlled spaces or supply sufficient electric heat internally to prohibit degradation from condensation.

1.12 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01 Section, "Execution & Closeout Procedures." In addition to the requirements specified in Division 01, indicate installed conditions for:
   1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
   2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 01 Section, "Execution & Closeout Procedures," to record the locations of underground installations.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01 Section, "Execution & Closeout Procedures." In addition to the requirements specified in Division 01, include the following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.

1.14 SYSTEM DEMONSTRATION AND OWNER'S INSTRUCTIONS

A. Demonstrate to the satisfaction of Owner's representative that electrical systems and components are operating properly.

B. Utilizing Operation and Maintenance Manual, provide Owner's representative(s) instruction in the operation and maintenance of systems.

C. Provide minimum of 8 hours formal instruction balanced as required between classroom type instruction and "hands-on" instruction for each of the following:
   1. Electrical Systems and Equipment

D. Provide additional instruction where necessary to fully prepare Owner to operate and maintain systems and components.

E. Refer to individual Division 26 sections for additional requirements.

F. Demonstration and instruction to begin after Substantial Completion and before final payment.

PART 2 - PRODUCTS -- Not Applicable

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Section, “Project Management & Coordination.” "CUTTING AND PATCHING." In addition to the requirements specified in Division 01, the following requirements apply:

B. Perform cutting, fitting, and patching of electrical equipment and materials required to:
   1. Remove existing work not to be reused or reconnected after completion.
   2. Uncover Work to provide for installation of ill-timed Work.
   3. Remove and replace defective Work.
   4. Remove and replace Work not conforming to requirements of the Contract Documents.
   5. Remove samples of installed Work as specified for testing.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect’s observation of concealed Work.

C. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers to prevent the spread of dust and dirt to adjacent areas.

F. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
   1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers.
   2. Patch specified finished surfaces and building components using new materials specified for the original installation and experienced installers.
   3. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Refer to Division 01 Section, “Definitions,” for definition of experienced "Installer."

G. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

H. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

I. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

J. Locate, identify, and protect electrical services passing through remodeling or demolition areas and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

3.2 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to drawings and equipment specifications in Divisions 02 through 23 for rough-in requirements.

3.3 ELECTRICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate electrical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of electrical materials and equipment or efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
7. Where mounting heights are not detailed or dimensioned, install electrical services and overhead equipment to provide the maximum headroom possible.
8. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, structural components, and the work of all other trades involved with the project.
9. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service. Do not interrupt electrical or telephone service without Owner's written permission.
10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer the conflict to the Architect.
11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
12. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
13. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section Access Doors and Panels and Division 26 Section, “Common Work Results for Electrical.” Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.4 WARRANTIES

A. Refer to the Division 01 Sections, “Substitution & Product Options,” and “Execution & Closeout Procedures,” for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 26, into a separated set of vinyl covered, three ring binders, tabulated and indexed by section for easy reference, refer to Division Number 01 for additional requirements.

C. Provide complete warranty information for each item, product, or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

3.5 CLEANING

A. Refer to the Division 01 Section, “Execution & Closeout Procedures” for general requirements for final cleaning.

B. Clean all light fixtures, lamps and lenses prior to final acceptance. Replace all inoperative lamps

END OF SECTION
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SECTION 260526 GROUNDING

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and other Division 26 Sections.

B. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these specifications.

C. Section 26 0533; Raceways.

D. Section 26 0536; Wires and Cables.

E. Section 26 2416; Panelboards.

1.2 SUMMARY

A. Extent of grounding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Solid grounding is the type of electrical grounding and bonding work specified in this section.

C. Application of electrical grounding and bonding work in this section includes the following:
1. Underground metal piping.
2. Underground metal water piping.
3. Underground metal structures.
4. Metal building frames.
5. Electrical power systems.
6. Grounding plate electrodes.
7. Grounding electrodes.
8. Counterpoise loops.
9. Separately derived systems.
10. Raceways.
11. Service equipment.
12. Enclosures.
13. Equipment.
14. Lighting standards.
15. Landscape lighting.
16. Signs.

D. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work not work of this section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each grounding system and accessories.

B. Shop Drawings: Submit wiring diagrams: for electrical grounding and bonding work which indicates layout of ground rings, location of system grounding electrode connections, routing of grounding electrode conductors, also include diagrams for circuits and equipment grounding connections.

C. Welding Certificates.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for grounding system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout, submit record drawings of installed systems, show the exact location of the ground components in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of electrical grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground electrodes and plate electrodes, and bonding jumpers 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 on projects with electrical grounding work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section, “Substitutions & Product Options.”

E. Welding Qualifications: Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and methods used in correcting welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes. Use of exothermic or "Cadweld" system is acceptable.

F. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467 "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use with Copper conductors". Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
3. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Burndy Corporation.
2. Caldweld Div.; Erico Products Inc.
3. Ideal Industries, Inc.
4. Thomas and Betts Corp.

2.2 MATERIALS AND COMPONENTS

A. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE requirements and with established industry standards for those applications indicated.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.

C. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.

D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 CM. Select braid with holes sized for 3/8" diameter bolts, and protect braid with copper bolt hole ends.

E. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

F. Ground Electrodes and Plates:
1. Ground Electrodes: Solid copper, 5/8" dia. x 10 ft.
2. Ground Electrodes: Steel with copper welded exterior, 3/4" dia. x 10 ft.
3. Ground Plates: Sheet copper plate, 20-gage x 36" x 36", with 2 cable attachments for either 1/0 or 2/0 cables.

G. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ELECTRICAL GROUNDING

A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. All connections to the grounding electrode shall be of the exothermic type.

D. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

E. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, boxes, grounding conductor in raceways and cables, receptacle ground connectors, motor frames and enclosures and plumbing systems.

F. Install counterpoises which encircle the building and are connected to each structural column, and to each driven electrode.

G. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.

H. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.

I. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

J. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.

K. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

L. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

M. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by installing and connecting additional ground rods; then retest to demonstrate compliance.

END OF SECTION
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SECTION 260533 RACEWAYS

PART 1 - GENERAL

1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and other Division 26 Sections.

B. Section 26 0536; Wires and Cables.

1.2 SUMMARY

A. Extent of raceway work is indicated by drawings and schedules or as required by equipment or system vendor. All wiring shall be installed in raceways.

B. Types of raceways specified in this section include the following:
1. Rigid metal conduit
2. Electrical metallic tubing (EMT)
3. Flexible metal conduit
4. Liquid-tight flexible metal conduit
5. Rigid nonmetallic conduit
6. Underground plastic utilities duct
7. Intermediate metal conduit.
8. Surface metal raceway.
9. Overhead metal raceway.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions for each type of raceway system required. Include data substantiating that materials comply with requirements.

B. Maintenance Data: Submit maintenance data and parts lists for each type of raceway system installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.

C. Codes and Standards:
1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements, and comply with applicable portions of NEC for raceways. All interior conduit and tubing shall be metallic.

B. Manufacturer of conduit, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Wheatland Tube
2. Wiremold
3. Square D
4. B-Line
5. Robintech
6. Triangle
7. Youngstown Steel
8. Walker
9. Carlon
10. Anaconda
11. Allied Tube and Conduit

C. Manufacturer of conduit fittings, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Appleton
2. Carlon
3. RACO
4. Steel City
5. Crouse-Hinds
6. Wheatland Tube

D. Manufacturer of conduit sealing products, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Dow Corning – Silicone RTV Foam.
2. Nelson – Flameseal.
3. 3m – Fire Barrier.
4. T & B – Flamesafe.

E. Rigid Metal Conduit: Provide rigid steel, zinc-coated, threaded type conforming to Fed. Spec. WW-C-581, ANSI C80.1 and UL 6. Provide zinc coating fused to inside and outside walls. All conduits over 2" in diameter shall be rigid metal.

F. Rigid Metal Conduit Fittings: Cast malleable iron, galvanized or cadmium plated, conforming to Federal Specification WW-C-581, ANSI C80.1 and UL 6.
   1. Use Type 1 fittings for raintight connections.
   2. Use Type 2 fittings for concrete tight connections.
   3. Use Type 3 fittings for other miscellaneous connections.

G. Electrical Metallic Tubing (EMT): Federal Specifications WW-C-563, ANSI C80.3 and UL 797.

H. EMT Fittings: Federal Specifications W-F-408. Compression fittings only. Do not use set-screw type or indenter fittings.

I. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded- conduit-entrance ends, removable covers, either cast or galvanized steel, and corrosion-resistant screws.

J. Flexible Metal Conduit: Federal Specification WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked zinc-coated strip steel.

K. Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type.
   1. Straight Terminal Connectors: One-piece, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
   2. 45 or 90 Degree Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.

L. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC). Exterior jacket shall be color stable when exposed to sunlight.

M. Liquid-Tight Flexible Metal Conduit Fittings: Federal Specifications W-F-406, Type 1, Class 3, Style G. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated or non-insulated throat.

N. Intermediate Steel Conduit: Rigid intermediate grade (IMC) hot-dip galvanized conforming to Fed. Spec. WW-C-581 and UL 1242.

O. PVC Externally Coated Rigid Steel Conduit: Rigid steel zinc-coated with additional external coating of PVC conforming to ANSI C80.1 and NEMA RN 1.

2.2 NONMETALLIC CONDUIT

A. General: Provide nonmetallic conduit and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements which comply with provisions of NEC for raceways.

B. Manufacturer of non-metallic conduit and fittings, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Hubbell.
2. Crouse-Hinds.
3. Arlington Industries Inc.
4. Thomas & Betts.
5. Appleton Electric

C. Electrical Plastic Conduit:
1. Heavy Wall Conduit: Schedule 40, 90 C, UL rated, construct of polyvinyl chloride and conforming to NEMA TC-2, for direct burial, or normal above-ground use, UL listed and in conformity with NEC Article 352.
2. Extra Heavy Wall Conduit: Schedule 80, UL rated, construct of polyvinyl chloride compound C-200 PVC, and UL listed in accordance with NEC Article 352 for direct burial, or above- ground use.

D. Provide all-weather quick-set clear cement and conduit bender designed specifically for PVC.

E. PVC Conduit and Tubing Fittings: NEMA TC 3, mate and match to conduit or tubing type and material.

F. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with manufacturer's published product information which mate and match conduit and tubing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF RACEWAYS

A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions and in compliance with NEC, and NECA's "Standards of Installation." Install units plumb and level, and maintain manufacturer's recommended clearances.

B. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

3.3 INSTALLATION OF CONDUITS

A. General: Install concealed conduits in new construction work, either in walls, slabs, or above ceilings. Run conduits concealed in existing work where practicable. Where conduits cannot be concealed in finished areas, use surface metal raceways.
   1. Mechanically fasten together metal conduits, enclosures, and raceways to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
   2. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
   3. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed.
   4. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
   5. Provide nylon pull cord in all empty conduits. Test conduits required to be installed, but left empty; test with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
   6. Minimum size of rigid, intermediate, and EMT conduits, for above grade homeruns only, shall be 3/4".
   7. Flexible conduit minimum size shall be 3/4", except final flexible conduit for lighting fixtures may be minimum size of 1/2".
   8. Power conduits 2" and larger, where located below 10’-0” above the finish floor and exposed, shall be rigid.
   9. Install control wiring in conduit according to these specifications.

B. Conduit Installation: Conduits underground and under-slab shall be PVC with rigid steel elbows. PVC conduit shall not penetrate the slab, all slab

penetrations shall be made with rigid steel elbows. Conduits for feeders inside the building and above 5’ above the finish floor shall be EMT. Provide rigid steel conduit for feeders that are exposed running from the floor to 5’ above the finish floor only. Conduits on the exterior of the building and exposed to weather shall be rigid steel. Follow minimum requirements in other areas as follows:

1. Galvanized rigid steel: Minimum 3/4-inch size may be used in all areas.
2. Electrical Metallic Tubing: Minimum 3/4-inch size may be used in indoor dry locations where it is:
   a. Not subject to damage.
   b. Not in contact with earth.
   c. Not in concrete slabs on grade.
   d. In compliance with other qualifications in this section.
3. Use flexible conduit in movable partitions and from junction boxes to recessed lighting fixtures (maximum of 6’-0” long), and final 24" of connection to motors, or control items subject to movement or vibration, and in cells of precast concrete panels. No flexible conduit shall be installed in permanent walls. No flexible conduit over 6'-0" in length shall be installed.
4. Refer to Division 26 Section, “Wires & Cables,” for Metal Clad (MC) cable use, requirements and installation requirements.
5. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
   a. Exterior location.
   b. Moist or humid atmosphere where condensate can be expected to accumulate.
   c. Corrosive atmosphere.
   d. Subjected to water spray or dripping oil.

C. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

D. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

E. Size conduits to meet NEC, except no conduit smaller than 3/4-inch shall be used for any feeder or branch circuit homerun.

F. Fasten conduit terminations in sheet metal enclosures by two locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

G. Conduits shall not cross pipe shafts or ventilating duct openings.

H. Conduits shall be a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

I. Support riser conduit at each floor level with clamp hangers.

J. Use of running threads at conduit joints and terminations is prohibited. Where required, use three-piece union or split coupling.

K. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

L. Install no more than the equivalent of four 90-degree bends between boxes. (Two 90-degree bends for telephone conduits, data conduits, and sound system conduit.)

M. Concealed Conduits:
1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
2. For floors-on-grade, install conduits under concrete slabs.
3. Install underground conduits minimum of 24" below finished grade.

N. Conduits in Concrete Slabs:
1. Place conduits between bottom reinforcing steel and top reinforcing steel.
2. Place conduits either parallel or at 90 degrees to main reinforcing steel.
3. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
4. Conduits crossing in slab must be reviewed for proper cover by Engineer.
5. Embedded conduit diameter shall not exceed 1/3 of slab thickness.
6. Turns within in the slab shall be with rigid conduit elbows when the turn is tighter than a 3’-0” radius.

O. Conduits shall not damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

P. Exposed Conduits:
1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed the following:
   a. up to 1": 6'-0"
   b. 1-1/4" and over: 8'-0"

4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
5. Above requirements for exposed conduits also apply to conduits installed in space above ceilings and in crawl spaces.

Q. Non-Metallic Conduits:
1. Make solvent cemented joints in accordance with recommendations of manufacturer. Clean joints and fittings with primer solvent before applying PVC cement.
2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
3. Where PVC is used below first floor slab, rigid steel ells shall be utilized in long radius form to extend vertically toward or through slab, and rigid steel entries into cabinets or terminal chambers, only shall be allowed. Do not extend any PVC into building spaces.

END OF SECTION
130627:1611071259

SECTION 260536 WIRES & CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

B. Section 26 0500; Common Work Results for Electrical.

C. Section 26 1300; Boxes and Fittings.

D. Section 31 2000; Earthwork.

1.2 SUMMARY

A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for electrical wires, cables and connectors. Include the insulation temperature rating and jacket type for each wire or cable.

B. Source quality-control report.

C. Field quality-control report.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications : Firms regularly engaged in the manufacture of wire and cable of types, materials 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 on projects with wire and cable systems work similar to that required for this project.

C. Source Limitations: Obtain each type of wire or cable through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Products Options."

E. Regulatory Requirements:
1. Comply with provisions of the NFPA 70 "National Electrical Code" (NEC).
2. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.

F. UL Compliance: Provide components which are listed and labeled by UL under the following standards.
1. UL Std. 4 Armored Cable.
2. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
3. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
4. UL Std. 486B Wire Connectors for Use with Aluminum Conductors.
5. UL Std. 854 Service Entrance Cable.

G. NEMA/ICEA Compliance: Provide components which comply with the following standards.
1. WC-1 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy per UL 493 and UL 719.
2. WC-1 Cross Linked Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy per UL 83.
3. WC-1 Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy per UL 1063.
4. WC-1 Metal Clad Cables 600V Type MC cables containing 4 conductors or less, in sizes 14-10 AWG per UL 1569.

H. IEEE Compliance: Provide components which comply with the following standard.
1. Std. 82 Test Procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Wire and Cable:
a. Southwire Co.
b. Phelps Dodge International Corp.
c. Prysmian Group.
d. Coleman Cable Inc.
e. Encore Wire Corp.
f. Senator Wire and Cable Co.
g. The Okonite Co.

h. General Cable.
i. AFC Cable Systems.
j. Cerro Wire.

2. Joints and Splices- Indent Type Pressure Connector for #8 AWG and Smaller:
   a. Buchanan.
   b. Burndy.
   c. Ideal.
   d. Thomas & Betts.

3. Joints and Splices- Insulated Spring Compression Connectors for #10 AWG and Smaller:
   a. Buchanan, Bcap.
   b. Ideal, Wing nut.
   c. ITT Holub, Free Spring.
   d. T & B, Piggy.
   e. 3M, Scotchlok.

4. Joints and Splices- Mechanical Compression or Bolted Type Connector for #6 AWG or Larger
   a. AMP, Inc.
   b. Anderson.
   c. Blackburn.
   d. Burndy Corp.
   e. General Electric Co.
   f. Ideal Industries.
   g. ITT Weaver.
   h. O.Z./Gedney Co.
   i. T & B.
   j. 3M Co.

2.2 WIRES & CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Conductors: Provide solid conductors for power and lighting circuits no. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger.

C. Conductor Material: Soft-drawn, annealed copper with a conductivity of 98% pure copper for all wires and cables.

D. Insulation:
   1. THHN for 600-volt and below for power wiring.
   2. Cabling installed in conduit as shown on Drawings or manufacturer recommended and Engineer approved cable for low voltage systems.
   3. Color coding for phase identification in accordance with Part 3 below.

E. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.

F. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. provide cable UL-listed for particular application:
1. Metal-Clad Cable: Type MC.

G. Lighting fixture "whips" shall be minimum of two No. 12 and one No. 12 ground and may be in 1/2" flexible conduit.

2.3 CONNECTORS FOR CONDUCTORS

A. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

B. Provide UL-listed factory-fabricated, pre-insulated solderless spring compression metal connectors on conductors No. 10 or smaller.

C. Use indent type pressure connectors on conductors No. 8 and smaller.

D. Use UL Listed mechanical compression or bolted type connectors on conductors No. 6 and larger.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated.
1. Wire: Install all wire in raceway.
2. Metal Clad Cable, Type MC: For 20 amp branch circuits (lighting and power) only and is not allowed for the circuit home run or in inaccessible areas such as above gypsum ceilings, in non-accessible plenum/attic spaces or in masonry walls. The branch circuit home run (from the panel to the first device) shall be conduit.

3.2 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires and connectors in compliance with NEC.

B. Coordinate cable installation with other work.

C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.

D. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable.

E. Conceal all cable in finished spaces.

F. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.

G. Keep conductor splices to minimum.

H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation rating than conductors being spliced.

I. Use splice and tap connectors which are compatible with conductor material.

J. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

K. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
   1. Minimum wire sizes shall be as follows:
      a. Branch circuits on 120/240 volt systems, #12 gauge, except on home runs longer than 100 feet actual wire length from center of the circuit to the panel, #10 gauge minimum.
      b. Control wiring: #14 gauge except on runs longer than 50 feet, #12 gauge minimum wire size.
      c. Fixture Wiring: #18 gauge, when factory installed.

   2. Communications and Signal Systems: as specifically required.
   3. Conductors: Size according to the National Electric Code.

L. Multiwire branch circuits with a “shared neutral” are NOT allowed for single phase circuits. The only allowed multiwire branch circuit with a “shared neutral” is a multi-pole individual branch circuit to a single piece of equipment (for example “current carrying conductors that share a common yoke”).

3.3 FIELD QUALITY CONTROL

A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.4 COLOR CODING FOR PHASE IDENTIFICATION

A. Color code conductor insulation for #8 AWG or smaller shall be with a factory applied continuous color. Identify circuit numbers at the end of the wire.

B. Provide 3" long bands of 1" wide colored tape at the end of wire at panelboards, cabinets and boxes for larger than #8 AWG conductors. Identify both phase and circuit numbers at these locations.

C. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

Voltage	120/240
Phase	single
Phase A	black
Phase B	red
Phase C	N/A
Neutral	white
Ground	green

END OF SECTION
130619:1611071310

SECTION 260548 SEISMIC PROTECTION

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 26 0533; Raceways.

C. Section 26 5100; Interior Lighting.

1.2 SUMMARY

A. Provide seismic protection for electrical equipment and conduit installation.

B. General: The requirements for seismic protection measures of this Section to be applied to electrical equipment and systems are in addition to any other items called for in other sections.

C. Electrical equipment shall include the following items to the extent required on Drawings or in other sections:
1. Light fixtures.
2. Motor control centers.
3. Switchboards (floor mounted).
4. Engine-drive generators.
5. Switchgear.
6. Unit substations.
7. Transformers.
8. Ducts

D. Zone
1. This facility is located in Seismic Zone D.

E. Exclusion
1. Seismic restraints may be omitted from all electrical conduit less than 2-1/2" inside diameter (i.d.).

1.3 REFERENCES

A. Comply with publications listed below:
1. American National Standards Institute, Inc.
a. ANSI B18.2.1 - Square and Hex Bolts and Screws Inch Series.

2. American Society for Testing and Materials.
   a. ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   b. ASTM A 325 - High Strength Bolts for Structural Steel Joints.

3. American Society of Mechanical Engineers.
   a. ASME B18.2.2 - Square and Hex Nuts (Inch Series).

4. Underwriters Laboratories.
   a. UL 1598 - Lighting Fixtures.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of bracing.

B. Shop Drawings: Submit shop drawings for seismic protection and bracing systems, showing materials, size, locations and elevations. Show interface and spatial relationship between brazed equipment and approximate structures.

C. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for system materials and products. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

G. Record Drawings: At project closeout, submit record drawings of installed bracing systems, show exact location and connection types and locations in accordance with the requirements of Division 01.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section Substitutions and Product Options.

E. Welding Qualifications: Qualify processes and operators according to ASME. 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.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Sway Brace: Structural steel conforming to ASTM A 36.

B. Lighting Fixture Supports: Malleable iron.

PART 3 - EXECUTION

3.1 SWAY BRACES

A. Install sway bracing on conduit to preclude damage during seismic activity. Brace conduit grouped for support on trapeze-type hangers at the same intervals as determined by smallest diameter conduit of the group. Do not fasten sway braces to dissimilar parts of a building that may respond in a different mode during an earthquake; for example, a wall and a roof.

B. Secure trapeze-type hangers with minimum of two 1/2" bolts.

C. Rigidly attach bracing to conduit except where it would interfere with thermal expansion of the conduit.

3.2 FLEXIBLE COUPLINGS OR JOINTS

A. Provide flexible couplings at bottom of all conduit risers larger than 2-1/2" in diameter (i.d.).

B. Install flexible couplings adjacent to the building on all underground conduit 4" and larger.

C. Install additional flexible couplings where shown.

3.3 ANCHOR BOLTS

A. Install floor and pad mounted equipment required by this Section with cast-in-place anchor bolts using 2 bolts per nut. If the size and number of anchor bolts are not shown, conform to the schedule for equipment weights or manufacturer's installation instructions, whichever is more stringent.

B. Anchor bolts that exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

C. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data is provided to verify the adequacy of the anchor and application. In no case shall the expansion anchor size be less than required for bolts in the schedule for equipment weights.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

A. Select anchor bolts for vibration isolation devices and snubbers to equipment base and foundations using the schedule for equipment by weight except use 5 times the actual equipment weight, or in accordance with manufacturer's installation instructions, whichever is more stringent.

3.5 MULTI-DIRECTIONAL SEISMIC SNUBBERS

A. Install multi-directions seismic snubbers employing elastomeric pads and providing 1/4" free vertical and horizontal movement from the static deflection point on all floor- or slab-mounted equipment.

B. Snubber Medium: Multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trucing so both horizontal and vertical forces are resisted by snubber medium.

3.6 EQUIPMENT SWAY BRACING

A. Provide bracing of angles, rods, bars, or pipes for all items support from overhead floor or roof structures. Secure bracing at both ends with minimum 1/2" bolts.

B. Provide sufficient bracing for equipment to resist a horizontal force equal to 113% of the weight of equipment without exceeding safe working stress of bracing components. Conform to schedule for maximum length for anchor braces.

C. In lieu of bracing with vertical supports, items may be supported with hangers inclined at 45° directed up and radially away from equipment and oriented symmetrically in 90° intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45° angle.

3.7 LIGHTING FIXTURE IN BUILDINGS

A. Pendant Fixtures: Provide loop and hook or swivel hanger assemblies fitted with a restraining device to hold the stem in the support position during earthquake motions. Provide pendant-supported fluorescent fixtures with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. Motion of swivels or hinged joints shall not cause sharp bends in conductors or damage insulation.

B. Recessed Fluorescent Fixtures: Support recessed individual and continuous-row mounted fixtures by a seismic-resistant suspended ceiling support system and bolt at each corner of fixture or provide fixture support wires attached to the building structural members using two wires for individual fixtures and one wire per unit on continuous row mounted fixtures.

C. Assembly Mounted on Outlet Box: Design supporting assemblies intended to be mounted on an outlet box to accommodate mounting features on 4" boxes, 3" plaster rings, and fixture studs.

D. Surface Mounted Fluorescent Fixtures: Provide seismic-resistant ceiling support system for individual and continuous-row mounted fixtures.
   1. Suspended Ceiling: Provide locking-type scissor clamp or full loop band securely attached to ceiling support system.
   2. Underside of Structural Slab: Anchor to slab at each corner of fixture.

E. Wall Mounted Emergency Light Unit: Securely anchor in-place to resist seismic disturbance.

3.8 TEST

A. In lieu of the requirements for equipment supports, lighting fixtures and the complete fixture-supporting assembly may be tested as specified hereinafter. Such tests shall be conducted by an approved and independent testing laboratory, and the results of such test shall specifically state whether or not the lighting fixture supports satisfy the requirements given herein.

B. Test Equipment: To simulate earthquake motion, attach fixtures and supports to a carriage suspended on rollers from an overhead track. Provide oscillatory

motion of approximately one cycle per second using a gear motor and crank assembly. Adjust the exact number of cycles per second and the actual dimensions of the crank apparatus to produce a minimum carriage acceleration of 0.28g. The actual fixture mounting surface shall be on the underside of the carriage and shall provide for orienting the fixture in a horizontal plane in various positions, ranging from parallel to perpendicular to the line of traverse.

C. Test Requirements: Conduct test with the maximum fixture weight to produce the most severe loading conditions. Test fixtures having stems with the actual stem length to be used. Test for 1 minute duration with the mounting surface in the line of traverse, at 45° to the line of traverse, and at 90° to the line of traverse. Test a total of 2 fixtures in each test position. After each of the six tests, subject stem assemblies to tensile strength test. The sample stems shall withstand, without failure, a force of not less than four times the weight it is intended to support.

D. Acceptance: No component of a fixture, not its supports shall be accepted individually. For acceptance, the fixture and its supports shall exhibit no undue damage, and no component of the fixture shall fail or fall from the fixture during testing.

E. Design Criteria: In lieu of the above test requirements, lighting fixtures shall be designed to resist a lateral force of 113 percent of the fixture weight.

F. Lighting Fixture Supports: Recessed lighting fixtures not over 56 pounds in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts.

3.9 MISCELLANEOUS EQUIPMENT

A. The following specific items of equipment to be furnished under this contract shall be constructed and assembled so as to be capable of withstanding the horizontal equivalent static force of 0.23 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake:
   1. Motor Control Centers.
   2. Engine-Generators.
   3. Substations.
   4. Transformers.
   5. Switch Boards and Switch Gear.
   6. Free Standing Electric Motors.

3.10 SCHEDULES

Minimum bolt sizes for cast-in-place anchor bolts:

Maximum Equipment Weight (Pounds)	Minimum Bolt Size (inches)* Zone 4	Zone 3	Zone 2	Zone 1
500	1/2	1/2	1/2	½
1,000	1/2	1/2	1/2	½
5,000	1/2	1/2	1/2	½
10,000	1/2	1/2	1/2	½
20,000	1/2	1/2	1/2	½
30,000	5/8	5/8	1/2	½
50,000	7/8	3/4	1/2	½
100,000	1-1/8	1	3/4	½

Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Use equivalent total cross-sectional area when more than four bolts per item are provided. Anchor bolts must conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least twelve times nominal diameter of the bolt.

END OF SECTION
130701:1611081115

SECTION 260553 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED WORK

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. Provide identification for products and systems.

B. Types of electrical identification work specified in this section include the following:
   1. Buried cable warnings.
   2. Electrical power, control and communication conductors.
   3. Electrical power, control and communication raceways.
   4. Electrical power systems operation and maintenance identification.
   5. Danger signs.
   6. Equipment/system identification signs or labels.
   7. Permanent nameplates.
   8. Color coding.

C. Provide field marking and identification of equipment and conductors in compliance with the NEC.
   1. Checklist for marking and identification is included for information.
      a. Section 110-27(c): Warning Sign for Exposed Parts.
      b. Section 110-22: Marking of Disconnects.
      c. Section 200-6(a,b,d): Identification of "grounded" conductor.
      d. Section 210-5(a): Identification of "grounded" conductor.
      e. Section 210-5(b): Identification of "grounding" conductor.
      f. Section 210-5(c): Identification of “ungrounded” conductors.
      g. Section 215-8: Identification of "high" leg (feeders).
      h. Section 230-2: Number and Location of Electrical Services.
      i. Section 230-56: Identification of "high" leg (services).
      j. Section 230-70(b): Identification of Service Disconnect.
      k. Section 230-72(a): Marking of Loads fed from Service Disconnect.
      l. Section 230-200: Requires Services Rated over 600V to Comply with All Markings Required for Services Rated 600V or less.
      m. Section 310-12: Identification of All Conductors.
      n. Section 408-3(e): Phase Arrangement in Switchboards and Panelboards.
      o. Section 110-22: Marking of Circuit Directory in Panelboards.

p. Section 430-74(a), Ex. No. 1: Marking of Control Power Disconnect for Motors.
q. Section 450-8(c): Warning Sign for Transformer Installations.
r. Section 517-19(a): Emergency Receptacles Indicating Panelboard and Circuit Number.
s. Section 517-160(a) (5): Identification of Isolated Power System Circuits in Health Care Facilities.
t. Section 620-51: Identification of Elevator Disconnects.
u. Section 620-53: Identification of Car Light Disconnects.
v. Section 645-10: Identification of Emergency Disconnect in Computer Rooms.
w. Section 700-8: Identification of Emergency Power Source(s).
x. Section 700-9(a): Identification of Emergency Power System Enclosures.
y. Section 760-10: Identification of Fire Signaling Circuits.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of identification.

B. Source quality-control reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of system products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Source Limitations: Obtain each type of identification through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Brady, W.H. Co.
2. Ideal Industries, Inc.
3. Seton Name Plate Co.
4. Panduit Corp.

2.2 MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Color-Coded Plastic Tape:
   1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide.
   2. Colors: Unless otherwise indicated or required by governing regulations. Provide color tape corresponding to color-coding of phase conductors.

C. Underground-Type Plastic Line Marker:
   1. General: Manufacturer's standard permanent, red-colored, continuous-printed detectable plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

D. Cable/Conductor Identification Bands:
   1. General: Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

E. Engraved Plastic-Laminate Signs:
   1. General: Provide engraving stock melamine plastic laminate, complying with ASTM D 709, in sizes and thicknesses indicated, engraved with engraver's standard letter style of 3/16” high and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
   2. Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.
   3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:
   1. Install electrical identification products as indicated in accordance with manufacturer's written instruction and requirements of NEC.
   2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Underground Cable Identification:
1. General: During backfilling/topsoiling of each exterior underground electrical, signal or communication cable, install continuous underground-type detectable plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install single line marker.
2. Install line marker for every buried cable regardless of whether direct-buried or protected in conduit.

C. Cable/Conductor Identification:
1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

D. Equipment/System Identification:
1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/4" high lettering on 1" high sign (1 1/2" high where 2 lines are required), white lettering in black field (red for 250-volt and over systems). Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
a. Panelboards, electrical cabinets and enclosures.
b. Access panel/doors to electrical facilities.
c. Major electrical switchgear.
d. Electrical substations.
e. Motor control centers.
f. Power transfer equipment.
g. Transformers.
h. Disconnect switches.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

3.2 SYSTEMS IDENTIFICATION

A. Identify systems by wire markers at the following locations:
   1. Mark all power and lighting branch circuits and feeders at pull boxes, fixtures, outlets, motors, etc., with markers indicating panel and circuit number at which each circuit or feeder originates.
   2. Mark all branch circuits in the panelboard gutters. Markers shall indicate corresponding branch circuit numbers.
   3. Mark all signal and control wires at all termination points, such as cabinets, terminal boxes, equipment racks, control panels, consoles, etc. Provide marking in accordance with approved schedules prepared by the system manufacturer.
   4. Indicate both ends of all pull wires by means of labels or tags, reading "PULL WIRE" and shall be numbered to refer to the same pull wire.

END OF SECTION
130624:1611071314

SECTION 261300 BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 26 0533; Raceways.

1.2 SUMMARY

A. Types of electrical boxes and fittings specified in this section include the following:
   1. Outlet boxes
   2. Junction boxes
   3. Pull boxes
   4. Bushings
   5. Locknuts
   6. Knockout closures
   7. Floor boxes
   8. Poke-throughs

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of box or specialty fitting.

B. Source quality-control reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section, “Substitutions & Product Options.”

E. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

F. UL Listing and Labeling: Provide items under this section listed and labeled by UL where a standard exists.

G. OSHA Reg. 1910-7 listing by an accredited laboratory is acceptable.

H. NEMA Compliance: Comply with applicable requirements of NEMA Standard 250, "Enclosures for Electrical Equipment."

I. ANSI/NEMA FB 1 for fittings and conduit bodies.

J. ANSI/NEMA OS 1 for sheet steel outlet boxes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Appleton Electric.
2. Bridgeport.
3. Crouse-Hinds.
4. Hoffman Co.
5. Hubbell, Inc.
6. Mulberry Metal Products Inc.
7. Neer.
8. O.Z. Gedney Co.
9. Pass and Seymour, Inc.
10. Quazite Corp.
11. Raco Manufacturing.
12. Steel City.
13. Square "D", Inc.
14. Thomas & Betts Co.
15. Walker/Wiremold Inc.

2.2 MATERIALS

A. Fixture Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes

with mounting holes, and conduit-sized knockout openings in bottom and sides. Provide boxes with threaded screw holes and device type box covers, and for equipment type grounding. Round boxes shall not be used.

1. Fixture Outlet Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.

B. Device Boxes: Provide galvanized coated flat rolled sheet-steel, non-gangable device box, 4" square, 2-1/8" deep. Provide plaster ring to flush out with finish wall. Provide grounding screw. Provide device box supports and mounting brackets as required.

C. Raintight Outlet boxes: Provide corrosion-resistant cast-metal raintight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast-metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant, plugs and fasteners.

D. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. Boxes shall have UL label and shall not be shop built. Locate junction and pull boxes above removable ceilings or in rooms with no ceiling.

E. Floor Boxes: Provide concrete-tight adjustable floor boxes as indicated, with threaded-conduit-entrance ends, and vertical adjusting rings and gaskets. Provide round metal covers with two large cable egress doors and 180-degree access opening. Box shall be equal to Hubbell model CFB2G30RCR with the cover equal to Hubbell model CFBS1R6CVR_ _ _ (color as selected by the architect).

F. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

2.3 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.

B. Bushings for terminating conduits 1" and larger are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. The bushing body is to be constructed of thermoplastic, bakelite, or steel.

C. Install insulated type bushings for terminating conduits 2-1/2" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

D. Bushing of standard or insulated type to have screw type grounding terminal.

E. Miscellaneous fittings such as reducers, chase nipples, three-piece unions, split couplings, and plugs to be specifically designed for their particular application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weathertight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Do not install boxes back-to-back in walls. Provide a minimum of 6" of separation.

G. Position recessed outlet boxes accurately to allow for surface finish thickness.

H. Set floor boxes level and flush with finish flooring material. Install floor boxes as directed by Architect.

I. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.

J. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

K. Provide electrical connections for installed boxes.

L. Subsequent to installation of boxes, protect boxes from construction debris and damage.

M. Do not use sectional or handy boxes.

N. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

O. Install outlets mounted above counters, benches, and back-splashes, coordinate with the millwork plans.

P. Position outlets to locate luminaires as shown on reflected ceiling plans.

Q. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

R. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

S. Provide cast outlet boxes in exterior locations exposed to the weather and wet locations.

T. Set switch boxes within 6 inches of door jamb where applicable.

3.2 DEMONSTRATION

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION
130624:1611071320

SECTION 261420 ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

C. This section is a Division 26 Basic Materials and Methods section and is part of each Division 23 and 26 section making reference to electrical connections for equipment specified herein.

D. Owner-furnished equipment has been defined from vendor's information current at commencement of design. Obtain latest rough-in from vendor prior to completing rough-in provisions.

1.2 SUMMARY

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electric connections are hereby defined to include connections used for providing electrical power to or receiving power from equipment.

B. Applications of electrical power connections specified in this section include the following:
   1. To motors.
   2. To lighting fixtures.
   3. To grounds, including earthing connections.

C. Refer to Division 23 sections for motor starters and controls furnished with equipment.

D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 26 sections.

E. Refer to Division 23 sections for control system wiring.

F. Refer to sections of other divisions for specific individual equipment power requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of connection specialty.

B. Source quality-control reports.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials including, but not necessarily limited to, disconnect switches, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire-nuts, and other items, accessories and specialties as needed to complete splices and terminations of types indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated in accordance with manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with equipment installation work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Maintain existing electrical service and feeders to occupied area and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

E. Cover splices with electrical insulation material equivalent to, or of greater insulation resistivity rating than electrical insulation rating of those conductors being spliced.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL 486A.

H. Fasten identification markers to each electrical power supply wire/cable conductor which indicate their voltage, phase and feeder number in accordance with Division 26 Section, “Electrical Identification.” Affix markers on each terminal conductor as close as possible to the point of connection.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirements. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION
130624: 1611071322

SECTION 261900 SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 26 0533; Raceways.

C. Section 26 1300; Boxes and Fittings.

1.2 SUMMARY

A. Provide conduit supports for the entire project complete.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of support products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Source Limitations: Obtain each type of support through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Singular Runs: Galvanized conduit straps or ring bolt type hangers with specialty spring clips. Do not use plumbers perforated straps.

B. Multiple Runs: Conduit rack with 25% spare capacity.

C. Vertical Runs: Channel support with conduit fittings, clamp type supports where conduits penetrate floors.

D. Trapeze Style Hangers: 1-5/8" x 1-5/8" galvanized steel channels, supported by 3/8" rod hangers.

2.2 ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or spider type expansion anchors.

B. Solid Masonry: Lead expansion anchors or preset inserts.

C. Metal Surfaces: Machine screws, bolts or welded studs.

D. Wood Surfaces: Wood screws.

E. Concrete Surfaces: Load expansion anchors with machine or lag bolts.

2.3 METAL FRAMING SYSTEMS

A. Provide metal framing systems for electrical equipment and conduits as required for proper support spacing and approved for the purpose.

B. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
   1. Powerstrut
   2. Unistrut
   3. Kindorf

C. All members and fittings to be galvanized, including screws, nuts, washers, inserts, springs, clamps, hangers, clips, and fittings.

2.4 SLEEVES

A. Where conduits pass through interior masonry or fire-rated walls, install 22-gauge galvanized sheet iron sleeves. Finish flush with each finished surface. Size sleeves to readily permit the subsequent insertion of conduits of the proper size. After conduits have been installed, close opening with flush escutcheon and firestop material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads as required.

B. Install horizontal supports at eight feet on centers, at fittings and corners, and as required for proper support.

C. Provide a complete installation with all channels, accessories, screws, nuts, washers, inserts, springs, clamps, hangers, clips, fittings, bracket framing fittings, post bases and brackets to provide a structurally rigid support or mounting system.

END OF SECTION

SECTION 262400 EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Division 23; Mechanical Equipment.

C. Section 26 0533; Raceways.

D. Section 26 0536; Wires and Cables.

1.2 SUMMARY

A. Provide feeder, branch circuit, control wiring, disconnects, and provide final connections to all equipment, including elevators, kitchen, medical, and Owner-furnished equipment.

B. Set, shim, align and check rotation of all motors not received as an integral part of any equipment assembly.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of system products of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. National Electrical Code References:
   1. Appliances: Article 422.
   2. Fixed Electric Space Heating Equipment: Article 424.

3. Motors, Motor Circuits and Controllers; Article 430.
4. Air-Conditioning and Refrigeration Equipment: Article 440.
5. Elevators: Article 620.

F. Safety Codes and Standards:
1. Enclosed Switches: UL 98.
2. Elevator Safety Code: ANSI A17.1.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of equpmment installed.

B. Shop Drawings: Submit shop drawings for transformers, showing dimensions, and weight loadings for transformer installations, showing layout, mountings and supports, spatial relationship to panelboards and associated equipment, include transformer connections to electrical equipment.

C. Wiring Diagrams: Submit wiring protection and control diagrams for equipment provided. Clearly differentiate between portions of wiring that are manufacturer installed and portions to be field installed.

D. Source quality-control reports.

E. Field quality-control reports.

F. Operation and Maintenance Manual Data: Include product data, shop drawings and record drawings in the maintenance manual. Include "trouble-shooting" maintenance guides. Furnish these materials with protective covering for storage and identified with labels describing the contents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Disconnect Switches:
1. Quick-make, quick-break operating mechanism.
2. Horsepower rated.
3. Voidable interlocked cover to prevent unauthorized opening in the ON position.
4. Padlocking provisions for locking in either the ON or OFF position.
5. Enclosures:
a. Indoor: NEMA 1 in dry areas, NEMA 3R in wet locations.
b. Outdoor: NEMA 3R.

6. Cabinets: NEMA 1 in dry areas, NEMA 3R in wet locations.

B. Time Switch
   1. 7-day electronic time switch.
   2. Type 1 gray painted steel case.
   3. 120/208/240/277 Volt AC 60 Hz operation.
   4. 2 – AAA batteries for battery backup.
   5. 1 single pole single throw 30 amp circuit.
   6. Equal to Intermatic Model No. ET1705C.

C. Photocell
   1. Equal to Intermatic Model No. K4321C with light shield Model No. K4000.

D. Lighting Contactor
   1. Provide a minimum of 3 spare poles in each contactor.
   2. NEMA type 1 enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install, wire and connect all equipment in compliance with manufacturers shop drawings, wiring diagrams and installation instructions.

3.2 TESTS AND DEMONSTRATION

A. After installation is complete, test and adjust the system.

B. After testing and making any necessary adjustments, demonstrate that the system is operating properly and performs the specified functions.

END OF SECTION
130625:1611071332

SECTION 262416 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of panelboard, load-center and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules, and as specified herein.

B. Types of panelboards and enclosures in this section include the following:
1. Lighting and appliance panelboards.

C. Refer to other Division 26 sections for cable/wire, electrical boxes and fittings, and raceway work required in conjunction with installation of panelboards and enclosures.

D. Wires/cables, electrical boxes and fittings, and raceways required in conjunction with the installation of panelboards and enclosures are specified in other Division 26 sections.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of panelboard and enclosure. Include wiring diagrams for panelboards showing connections to electrical power feeders and distribution branches.

B. Source quality-control reports.

C. Field quality-control reports.

D. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for panelboards and enclosures. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

E. Record Drawings: At project closeout, submit record drawings of installed panelboard locations and circuit number modifications in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of panelboards and enclosures of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 15 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of equipment through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. Codes & Standards:
   1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 408 as applicable to installation, and construction of electrical panelboards and enclosures.
   2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL's 50, 467, 486A, 486B, 489, 869 and 1053 pertaining to panelboards, accessories and enclosures. Provide units which are UL-listed and labeled.
   3. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL marks which indicates that special type of use/application.
   4. NEMA Compliance:
      a. Comply with NEMA Standards Pub/No. 250, "Enclosures for Electrical Equipment (1000 Volt Maximum)",
      b. Comply with NEMA Standards. Pub/No. PB 1, "Panelboards", and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."
      c. Comply with NEMA Standards. Pub/No. AB 1, for molded case circuit breakers.

   5. ANSI Compliance: Comply with ANSI Z55.1 for panelboard finishes.

1.5 SEQUENCING & SCHEDULING

A. Coordinate installation of panelboards and enclosures with installation of wires/cables, electrical boxes and fittings, and raceway work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
   1. Cutler-Hammer Products, Eaton Corp.
   2. General Electric Company.
   3. Siemens-Allis, Inc.
   4. Square D Company.

2.2 LIGHTING AND APPLIANCE PANELBOARD TYPE

A. NQ or NQOD
   1. Interior
      a. Shall be type NQ or NQOD panelboard rated for 240 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum.
      b. Minimum short circuit current rating: As indicated in rms symmetrical amperes at 240 Vac.
      c. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated aluminum. Bussing rated for 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
      d. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
      e. A solidly bonded aluminum equipment ground bar shall be provided.
      f. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.
      g. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA and UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

h. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be [horizontally] [vertically] mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

i. Interior phase bus shall be pre-drilled to accommodate field installable options, i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs.

2. Main Circuit Breaker

a. The main circuit breaker shall be of the same manufacturer as the panel and branch breakers.

b. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.

c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

d. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.

e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.

f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.

g. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

3. Branch Circuit Breakers

a. The branch circuit breakers shall be of the same manufacturer as the panel and the main breakers. Circuit breakers shall be UL Listed with

amperage ratings, interrupting ratings, and number of poles as indicated on the associated drawings.

b. Molded case branch circuit breakers shall have bolt-on type bus connectors.

c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.

e. The exposed faceplates of all branch circuit breakers shall be flush with one another.

f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.

g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.

4. Enclosures

a. Type 1 Boxes

1) Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.

2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

3) Box width shall be 26” wide maximum.

b. Type 1 Fronts

1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

2) Fronts shall be hinged 1-piece with door. Mounting shall be as indicated on associated drawings.

3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.

4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standards of Installation", and in compliance with recognized industry practices 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 torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

D. Provide properly wired electrical connections within enclosures.

E. Fill out panelboard's circuit directory card upon completion of installation work.

F. Insert fuses, if any, of ratings indicated, within installed panelboards.

3.3 GROUNDING

A. Provide equipment grounding connections for panelboards as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds. Bond panelboard ground bus kits together as required by NEC Article 517-14.

3.4 FIELD QUALITY CONTROL

A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.

B. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled. Record values for maintenance procedures beginnings.

C. Prior to energization, check panelboards for electrical continuity of circuits, and for short-circuits.

3.5 ADJUSTING & CLEANING

A. Adjust operating mechanism for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finishes.

3.6 DEMONSTRATION

A. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION
130624:1611071340

SECTION 262726 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED WORK

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. Provide wiring devices and plates, complete.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions, ratings and dimensioned drawings for each type of device.

B. Source quality-control reports.

C. Field quality-control reports.

D. Operation and Maintenance Manual Data: Include product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing the contents.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of devices of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of device through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Substitutions & Product Options."

E. National Electrical Code References:

1. Switches: Article 404.
2. Receptacles: Article 406.

F. Safety Standards:
1. Switches: UL 20.
2. Receptacles: UL 498.
3. Plates: UL 514D.
4. Ground Fault Circuit Interrupters: UL 943.

G. Manufacturer's Standards:
1. NEMA WD-1.
2. ANSI C 73A.

H. All devices shall be specification grade, minimum.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer, subject to compliance with requirements, shall be one of the following or an Engineer approved equivalent:
1. Hubbell
2. Pass & Seymour
3. Leviton
4. Cooper

2.2 MATERIALS

A. Devices
1. Switches: Heavy duty, AC quiet type, toggle handle, 20 amp, 120-277 volts, equal to Hubbell No. CS1201.
   a. Three-way Switches: Heavy duty, AC quiet type, toggle handle, 20 amp., 120-277 volts, equal to Hubbell No. CS3201.
   b. Four-way switch: Heavy duty, AC quiet type, toggle handle, 20 amp., 120-277 volts, equal to Hubbell No. 1224.
   c. Dimmer Switch: 0-10 volts, LED dimmer equal to Lutron NovaT NTSTV-DV.
   d. Timer Switch: Commercial, 20 (8 max. load) amp, 120-277 volts, 30 minute max timer, equal to Hubbell No. DT5050W.
   e. Occupancy Sensor: Commercial, passive infrared technology, manual time delay adjustment (20 sec. to 30 min.), auto on operation, 20 amp, 120 volt AC only equal to Hubbell No. WS1000W.

2. Receptacles/Plug-in Devices:

a. Duplex Receptacles: Heavy duty, 2 pole, 3 wire, grounding, 20 amp, 125 volts, equal to Hubbell No. 5352 series, corrosion resistant on exterior.
b. Ground Fault Circuit Interrupters: Heavy duty, Class A, 20 amp, 125 volts, equal to Hubbell GF-5362 series, for individual receptacle protection or feed-thru installation.

B. Colors:
a. Devices, unless noted otherwise on the plans shall be white. Verify prior to ordering.
b. Emergency Devices, unless noted otherwise on the plans shall be red. Verify prior to ordering.

C. Device Plates:
1. aluminum equal to Hubbell No. WP26E_ for vertical or horizontal applications.
2. Materials:
a. Molded of impact resistant thermoplastic, equal to Hubbell NP series.
b. 0.04 inch thick, type 302, satin finished stainless steel.

3. Colors:
a. Wall mounted device plates shall be stainless steel.
b. Ceiling mounted device plates shall be white thermoplastic.

D. Labeling:
1. For standard duplex and single receptacles, indicate on the backside of the receptacle faceplate, with a black permanent marker, the panel and circuit number feeding the receptacle.
2. On other than standard duplex and single receptacles, provide an engraved or embossed face plate indicating the voltage, phase, amperes, panel name and circuit number.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Where switches operate vertically, single or double pole switches shall be "ON" in the upper position. If operated horizontally, single or double switches shall be “ON” in the right position. Where more than one switch is shown at one outlet, install under one plate in an order appropriate to the location of the outlets controlled.

B. Mount duplex receptacles vertically.

C. All duplex receptacles mounted vertically shall have ground prong hole in lower position. All duplex receptacles mounted horizontally shall have ground prong hole in left position.

D. Install plates with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Mount switches flush with plate so switch handle will not strike plate.

E. Mounting heights shall be to the centerline of the device in permanent walls (unless otherwise specified):
   1. Duplex and single receptacles 18" above finish floor.
   2. Receptacles, data or telephone outlets above counters (coordinate with the counter and the cabinetry) 6" above backsplash.
   3. Telephone outlets 18" above finish floor.
   4. Data outlets (computer-printer) 18" above finish floor.
   5. Wall switches-dimmers 46" above finish floor.
   6. GFI receptacle in toilet room (unless noted to be above the counter) 42"above finish floor.

END OF SECTION
130625:1611071345

SECTION 265100 INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Section 26 0533; Raceways.

C. Section 26 0536; Wire and Cable.

D. Section 26 2726; Wiring Devices.

1.2 SUMMARY

A. Provide a complete lighting system as shown and specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, specifications, installation instructions and dimensioned drawings for each type of light fixture. Include certified photometric data including CU and VCP tables for each light fixture specified. Submit IES data for fixtures upon request.

B. Shop Drawings: Submit shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.

C. Wiring Diagrams: Submit wiring diagrams for lighting fixtures showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

D. Samples: Submit samples upon request.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for each lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings and record

drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

H. Extra Stock: Furnish stock or replacement lamps amounting to 15% (but not less than one lamp of each type) of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space, and obtain receipt.

I. Record Drawings: At project closeout, submit record drawings of installed light fixtures, show exact location and associated circuitry in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of light fixtures of types, materials 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 on projects with light fixtures similar to that required for this project.

C. Source Limitations: Obtain each type of light fixture and accessory through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section, "Substitutions & Product Options."

E. Codes and Standards
   1. Electrical Code Compliance: Comply with the applicable National Electrical Code (NEC) references:
      a. Article 210, "Branch Circuits."
      b. Article 250, "Grounding and Bonding."
      c. Article 400, "Flexible Cord and Cables."
      d. Article 402, "Fixture Wires."
      e. Article 410, "Luminaires, Lampholders, and Lamps."

   2. UL Compliance: Comply with applicable requirements of UL Standards and provide light fixtures and components which are UL-Listed and labeled per the following standards:
      a. Standard 62, "Flexible Cords and Cables."
      b. Standard 66, "Fixture Wire."
      c. Standard 153, "Standard for Portable Electric Luminaires."
      d. Standard 183, "Standard for Manufactured Wiring Systems."
      e. Standard 486A-486B, "Wire Connectors."
      f. Standard 496, "Lampholders."
      g. Standard 542, "Standard for Fluorescent Lamp Starters."

h. Standard 676, "Standard for Underwater Luminaires and Submersible Junction Boxes."
i. Standard 1574, "Standard for Track Lighting Systems."
j. Standard 1581, "Reference Standard for Electrical Wires, Cables and Flexible Cords."

3. NEMA Compliance: Comply with applicable portions of the following NEMA Standards:
   a. Publication No. BL 1, "Fluorescent Ballast Connector."
   b. Publication No. BL 2, "Energy Efficiency for Electronic Ballasts for T8 Fluorescent Lamps."
   c. Publication No. LL 7, "Generic Designation System for Pin-Based Compact fluorescent and T5 Twin Fluorescent Lamps."
   d. Publication No. LL 9, "Dimming of T8 Fluorescent Lighting Systems."
   e. Publication No. LE 4, "Recessed Luminaires-Ceiling Compatibility."
   f. Publication No. LE 5, "Procedure for Determining Luminaire Efficacy Ratings for Fluorescent Luminaires."

4. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 COORDINATION

A. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of exterior lighting fixtures with other work.

B. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting fixtures with other work.

C. Sequence lighting installation with other work to reduce possibility of damage and soiling of fixtures during remainder of construction period.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver exterior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from construction debris and physical damage.

B. Store exterior lighting fixtures in original wrappings in a clean dry place. Protect from weather, dirt, fumes, water, construction debris, and damage.

C. Handle exterior lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from site and replace with new.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to the following:
   1. Driver failures.
   2. Faulty operation of controls.
   3. Deterioration of any competent beyond the degradation of normal use.

B. Warranty Period(s) from date of Substantial Completion:
   1. Provide a one (1) year parts and labor warranty for the complete fixture.
   2. Provide a two (2) year parts only warranty on the fixture ballast.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers, subject to compliance with requirements, shall be the following or an Engineer approved equivalent(s):

B. Fixtures.
   1. Williams.
   2. Cooper.
   3. Hubbell.
   4. LBL.
   5. Philips.
   6. LSI.
   7. Holophane.
   8. Advent.
   9. Lithonia Lighting.

C. Emergency Fixtures.
   1. Dual-Lite.
   2. Williams.
   3. Cooper.
   4. Chloride.

D. Drivers.
   1. Advance.
   2. Osram-Sylvania.
   3. Venture.

2.2 MATERIALS

A. Fixtures: Provide lighting fixtures of rigid construction, dimensionally stable, and assembled with secure fastenings. Protect ferrous parts from corrosion by

plating or finish with high reflectance enamel with non-yellowing binder and high pigment to binder ration, with matte finish. Prepare ferrous parts for finish by a 5 state phosphatizing process. Finish aluminum parts used as reflector surfaces with Alzak process. Firmly support shielding materials, make tight, with no loose panels or parts, and showing no leaks of unshielded or unintentional light. All plastics used in shielding shall be virgin acrylic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide fixture wiring suitable for the temperature rating of the fixture. Where a junction box is required to change from branch circuit to fixture wiring, use approved pre-wired fixtures or install a separate junction box, at the Contractor's option. Provide fully accessible junction box after installation of covering materials. Where flexible conduit, MC cable or portable cord is used, install a grounding jumper; ground all fixtures.

B. Suspend lighting fixtures from structural members or from ceiling structural members, by minimum 1-1/2 inch channels, by standard bar hangers, or other approved means. Under no circumstances will they be suspended from the ceiling. Coordinate fixture locations with ceiling patterns. Refer to architectural room finish schedule for ceiling construction details and mounting heights.

C. Provide structural steel necessary to support the fixtures under this section. Provide plaster frames as required. Where lighting fixtures located in plaster ceilings have a square or rectangular pattern, provide necessary corner plaster frames for a complete system.

D. The lighting fixture schedule shown on the contract document indicates the type of fixture required but the contractor shall provide the proper fixture for the ceiling type as indicated in the architectural finish schedule.

3.2 TESTS AND DEMONSTRATIONS

A. After installation is complete, test and adjust the system.

B. After testing and making any necessary adjustments, demonstrate to the Owner's representative that the system is operating properly and performs the specified functions.

END OF SECTION
130627:1611071349

SECTION 265600 EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Division 26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

A. Extent of exterior lighting fixture work is indicated by drawings and schedules.

B. Types of exterior lighting fixtures in this section include the following:
   1. LED

C. Applications of exterior lighting fixtures required for project include the following:
   1. Outdoor area lighting.
   2. Outdoor security lighting.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for each type of exterior light fixture and accessory. Include certified photometric data including CU and VCP tables for each light fixture specified. Submit IES data for fixtures upon request.

B. Shop Drawings: Submit shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.

C. Wiring Diagrams: Submit wiring diagrams for exterior lighting fixtures showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field-installed.

D. Illumination Data: Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows composite values of illuminance projected from the arrangement of light sources from indicated fixture locations

and heights. Show on the graphic plots the locations, spacings and heights of luminaires.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for each exterior lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings and record drawings in the maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing contents.

H. Extra Stock: Furnish stock or replacement lamps amounting to 15% (but not less than one lamp of each type) of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Owner's storage space, and obtain receipt.

I. Record Drawings: At project closeout, submit record drawings of installed systems, show exact location and circuitry information in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in the manufacture of exterior lighting fixtures of types, materials 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 on projects with systems work similar to that required for this project.

C. Source Limitations: Obtain each type of light fixture and accesory through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section, “Substitution & Product Options.”

E. Codes and Standards:
   1. Electrical Code Compliance: Comply with the applicable National Electrical Code (NEC) references:
      a. Article 210, “Branch Circuits.”
      b. Article 250, “Outside Branch Circuits and Feeders.”
      c. Article 250, “Grounding and Bonding.”
      d. Article 402, “Fixture Wires.”
      e. Article 410, “Luminaires, Lampholders, and Lamps.”

2. UL Compliance: Comply with applicable requirements of UL Standards and provide light fixtures and components which are UL-Listed and labeled per the following standards:
   a. Standard 62, “Flexible Cords and Cables.”
   b. Standard 66, “Fixture Wire.”
   c. Standard 153, “Standard for Portable Electric Luminaires.”
   d. Standard 183, “Standard for Manufactured Wiring Systems.”
   e. Standard 486A-486B, “Wire Connectors.”
   f. Standard 496, “Lampholders.”
   g. Standard 542, “Standard for Fluorescent Lamp Starters.”
   h. Standard 676, “Standard for Underwater Luminaires and Submersible Junction Boxes.”
   i. Standard 1581, “Reference Standard for Electrical Wires, Cables and Flexible Cords.”

3. NEMA Compliance: Comply with applicable portions of the following NEMA Standards:
   a. Publication No. BL 1, “Fluorescent Ballast Connector.”
   b. Publication No. BL 2, “Energy Efficiency for Electronic Ballasts for T8 Fluorescent Lamps.”
   c. Publication No. LL 7, “Generic Designation System for Pin-Based Compact fluorescent and T5 Twin Fluorescent Lamps.”
   d. Publication No. LE 5, “Procedure for Determining Luminaire Efficacy Ratings for Fluorescent Luminaires.”

4. IES Compliance: Comply with IES RP-8, 19, 20, and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.
5. NFPA Compliance: Comply with applicable requirements of NFPA 78, "Lightning Protection Code", pertaining to installation of exterior lighting fixtures.
6. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 COORDINATION

A. Coordinate the size and location of concrete bases with actual equipment provided and structural and architectural plans.

B. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of exterior lighting fixtures with other work.

C. Sequence exterior lighting installation with other work to reduce possibility of damage and soiling of fixtures during remainder of construction period.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver exterior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from construction debris and physical damage.

B. Store exterior lighting fixtures in original wrappings in a clean dry place. Protect from weather, dirt, fumes, water, construction debris, and damage.

C. Handle exterior lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from site and replace with new.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to the following:
   1. Driver failures.
   2. Faulty operation of controls.
   3. Deterioration of any component beyond the degradation of normal use.

B. Warranty Period(s) from date of Substantial Completion:
   1. Provide a one (1) year parts and labor warranty for the complete fixture.
   2. Provide a two (2) year parts only warranty on the fixture ballast.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers, subject to compliance with requirements, shall be the following or an Engineer approved equivalent:

B. Fixtures
   1. Williams.
   2. LSI Industries Inc.
   3. Philips.
   4. Cooper Lighting.
   5. Crouse-Hinds Lighting Products Div; Cooper Industries Inc.
   6. Devine Lighting Div; Kidde & Co., Inc.
   7. Dual-Lite Mfg. Inc.
   8. Emco.
   9. Emerson Electric Co.
   10. Gardco.
   11. General Electric Co.
   12. Sylvania, Inc.
   13. Guth Lighting Div; General Signal Corp.
   14. Holophane.
   15. KIM Lighting, Inc.
   16. Lithonia Lighting.

17. McGraw-Edison Co.
18. Wide-Lite Corp., Div of Philips.

C. Drivers
1. Advance.
2. Osram-Sylvania.
3. Venture.

2.2 EXTERIOR LIGHTING FIXTURES

A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters and wiring.

B. Wiring: Provide electrical wiring within fixture suitable for connection to branch circuit wiring as follows:
1. NEC Type AF for 120-volts, minimum No. 18 AWG.

C. Exterior Lighting Fixture Types: Fixtures are scheduled on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate which will support lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EXTERIOR LIGHTING FIXTURES

A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures 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 torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B, and the National Electrical Code.

C. Fasten electrical lighting fixtures and brackets securely to indicated structural supports, including poles/standards; and ensure that installed fixtures are plumb and level.

3.3 GROUNDING

A. Provide equipment grounding connections for exterior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL

A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

B. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect.
   1. Refer to Division 01 sections for the replacement/restoration of lamps in exterior lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.

3.5 ADJUSTING AND CLEANING

A. Aim adjustable lighting fixtures and lamps in night test of system. Verify that measured illuminance values comply with isolux plot diagram values.

B. Clean exterior lighting fixtures of dirt and debris upon completion of installation.

C. Protect installed fixtures from damage during construction period.

3.6 DEMONSTRATION

A. Upon completion of installation of exterior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION
130627:1611071353

SECTION 333100 SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED WORK

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

B. Division 03; sections for concrete work required for sanitary sewage systems.

C. Division 23; "Soil and Waste Systems" for interior building systems including drain, waste, and vent piping.

D. Division 31; "Earthwork" for excavation and backfill required for sanitary sewage system.

1.2 SUMMARY

A. Extent of sanitary sewage systems work is indicated on drawings and schedules, and by requirements of this section.

B. Sewer collection system work includes sanitary sewer conduits.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data, specifications, installation instructions and dimensioned drawings for pipe, fitting, accessory or specialty for sewerage system materials and products.

B. Shop Drawings: Submit shop drawings for sanitary sewerage system, showing piping materials, size, locations, and inverts. Include details of underground structures, connections, and cleanouts. Show interface and spatial relationship between piping and proximate structures.

C. Certificates of Shop Inspections and Data Reports: For products required to have ASME label, signed by product manufacturer.

D. Welding Certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

E. Source quality-control reports.

F. Field quality-control reports.

G. Record Drawings: At project closeout, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division 01.

H. Operation and Maintenance Manual Data: Submit maintenance data and parts lists for sanitary sewerage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual. Furnish these materials with protective covering for storage and identified with labels describing the contents in accordance with the requirements of Division 01.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of sanitary sewage system products of types, materials, 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 on projects with sanitary sewerage systems work similar to that required for this project.

C. Source Limitations: Obtain each type of sanitary sewerage piping, fitting and accessory through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of the system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

E. Codes and Standards:
1. Plumbing Code: Comply with the requirements of the International Plumbing Code or of the code as adopted by the authority having jurisdiction.
2. Arkansas: Comply with the applicable portions of the Arkansas Plumbing code and regulations pertaining to sanitary sewage systems.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Plastic Line Marker: Manufacturer's standard, permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BELOW".

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:
1. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:

a. Emed Co., Inc.
b. Seton Name Plate Corp.

2.2 PIPES & PIPE FITTINGS

A. Furnish ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions, and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the architect.

B. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35. Fittings: PVC, ASTM D 3033 or ASTM D 3034, solvent-cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2564; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

C. Polyvinyl Chloride (PVC) DWV Pipe: Schedule 40, ASTM D 2665. Fittings: PVC Schedule 40, ASTM D 2665; solvent-cement joints, ASTM D 2664; or threaded joints.

D. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM F 679, wall thickness T-1. Fittings: PVC, ASTM F 679, elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.

2.3 CLEANOUTS

A. General: Provide as indicated, pipe extension to grade with ferrule and countersunk cleanout plug. Provide round cast-iron access frame set in concrete over the cleanout, with a heavy-duty secured scoriated cover with lifting device.

PART 3 - EXECUTION

3.2 PIPING SCHEDULE

A. Exterior below grade piping shall be:
1. Polyvinyl Chloride pipe.

3.3 INSPECTION

A. General: Examine areas and conditions under which sanitary sewer system materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.4 INSTALLATION OF IDENTIFICATON

A. General: During back-filling/top-soiling of sanitary sewer systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade.

3.5 INSTALLATION OF PIPE & FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

C. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.

D. Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.

E. Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
   1. In large, accessible piping, brushes and brooms may be used for cleaning.
   2. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
   3. Flush lines between manholes if required to remove collected debris.

F. Joint Adapters: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.

3.6 CLOSING ABANDONED UTILITIES

A. Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.

B. Close open ends of concrete or masonry utilities with not less than 8" thick brick masonry bulkheads.

C. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods for size and type material being closed. Wood plugs are not acceptable.

3.7 INTERIOR INSPECTION

A. Inspect piping to determine whether line displacement or other damage has occurred.

B. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2-ft. of backfill is in place, and again at completion of project.

C. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.8 TAP CONNECTIONS

A. Make connections to existing piping and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.

B. Use commercially manufactured wyes for branch connections. Field cutting into piping will not be permitted. Spring wyes into existing line and encase entire wye, plus 6" overlap, with not less than 6" of 3,000 psi 28-day compressive strength concrete.

C. Branch connection made from side into existing 4” to 21” piping shall have wye sprung into existing line, and entire wye encased with not less than 6” of 3,000 psi 28-day compressive strength concrete.

D. For branch connections from side into existing 24" or larger piping or to underground structures, cut opening into unit sufficiently large to allow 3" of concrete to be packed around entering connection. Cut ends of connection passing through pipe or structure to conform to shape of, and be flush with, inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6" of concrete for a minimum length of 12" to provide additional support or collar from connection to undisturbed ground.
   1. Provide concrete which will attain minimum 28-day compressive strength of 3,000 psi, unless otherwise indicated.
   2. Use epoxy bonding compound as interface between new and existing concrete and piping materials.

E. Take care while making tap connections to prevent concrete or debris from entering existing piping or structure. Remove debris, concrete, or other extraneous material which may accumulate.

3.9 BACKFILLING

A. General: Conduct backfilling operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed. To minimize local area traffic interruptions, allow no more than 100 ft. between pipe laying and point of complete backfilling.

3.10 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

END OF SECTION
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